APRIL 1950

INDUSTRY AND POWER

Engineering Library

A Magazine for Plant Engineers and Executives

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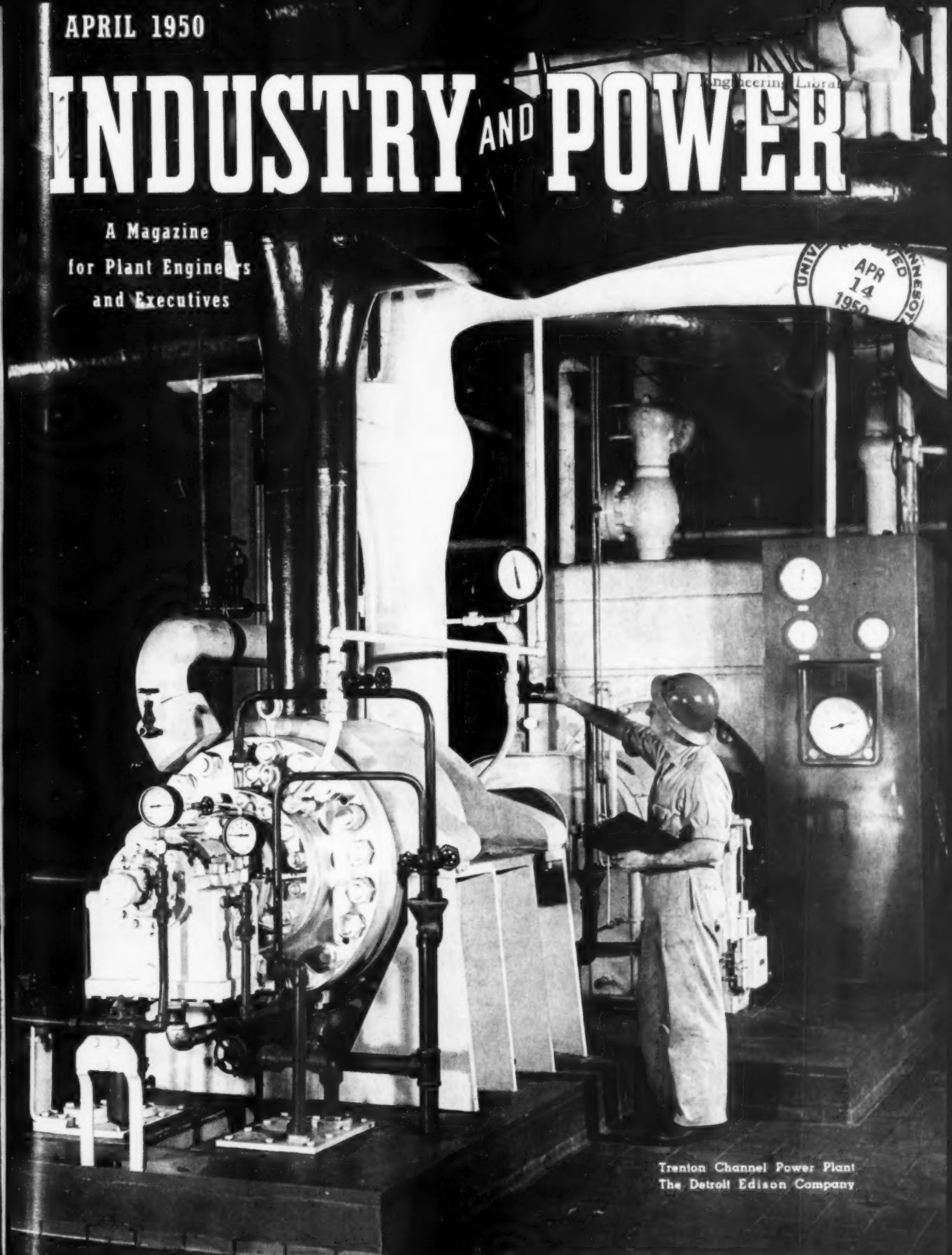

Trenton Channel Power Plant
The Detroit Edison Company

PLEASE ROUTE TO

President	Gen. Mgr.	Superintendent	Plant Engineer	Chief Engineer	Power Engineer	Engineering Dept.	Electrical Dept.	Maintenance Dept.	Purchasing Dept.

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the HARD WAY

to solve your water conditioning problem —

Consider these factors: *Source of water*: Degree of hardness, alkalinity, turbidity, mineral and organic impurities, sludge forming characteristics, corrosiveness, seasonal variations, temperature ranges, etc. *Results required*: Degree of clarity, softness, alkalinity, residuals, stabilization, purity, taste and odor correction, iron removal, corrosion control, blended water, etc. *Method of treatment*: Water softener, chemical feed, concentration control, aeration, filtration, deconcentration, oil removal, pre-treatment, post-treatment, de...kalization, combination system, modernization of existing equipment, investment cost, etc. *Operating factors:* Cost, savings versus investment, operating skill required, critical limitations, plant balance, load factors, operating ranges, space requirements, etc.

and the EASY WAY: *call on* ELGIN!

We show above just a partial listing of the factors that often must be considered in solving a water conditioning problem. Our purpose is not to worry you with complexities, but to show you how unsound it is to entrust your water conditioning problem to an organization that is limited in experience and in scope of methods and equipment.

Naturally if the organization is limited to zeolite softeners, the solution proposed to your problem will be zeolite softeners . . . if limited to chemical treatments, the proposed solution will be chemical treatments . . . and so on down the list.

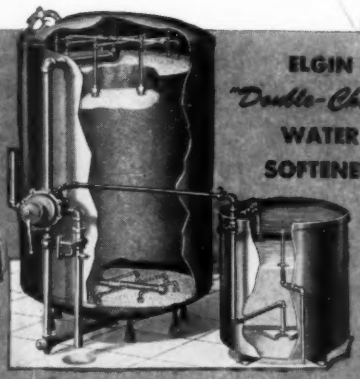
On the other hand, Elgin (utilizing all authoritative methods) is bound to no method but the *BEST*. For example, the most spectacular of all Elgin achievements is the dollar-saving Elgin "Double-Check" Softener described opposite . . . yet . . . you can't buy it unless an analysis of your condition convinces us that it is both the best and most economical solution of your water conditioning problem! And this holds true for every product in the Elgin line.

Yes, through Elgin you get the counsel of a firm that has seen enough conditions to *recognize* your needs; the counsel of a firm that is in a position to apply the method that exactly *suits* your needs. For a complete check-up of your requirements there is no cost or obligation whatever.

ELGIN SOFTENER CORPORATION

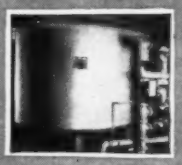
138 North Grove Avenue

Elgin, Illinois



ELGIN "Double-Check" WATER SOFTENER

By preventing loss of zeolite the "Double-Check" design of the Elgin Softener permits a far larger bed of zeolite and utilizes it more efficiently. Result: 44% more soft water per regeneration than other softeners of same size using same type zeolite. "Double-Check" principle is also adaptable (at low cost) to your present softener of any make.



FILTERS — PURIFIERS

Elgin Water Filters and Purifiers for any filtration or purification requirement. Pressure Filters, with quartz or non-siliceous filtering medium, remove suspended impurities, including iron in suspension. Taste and Odor Removal Filters remove bad tastes and odors, including chlorine.

CHEMICAL FEED SYSTEMS

Many water conditioning problems are best and most economically solved by feeding the right chemical treatment in the right way. Elgin chemical treatments, individually formulated to meet specific conditions and properly fed by dependable Elgin chemical feeders, may prove to be the best answer to your needs.

DECONCENTRATORS

The Elgin Deconcentrator keeps boiler water clean—rids boiler of sludge, mud, and scale-forming matter — eliminates wasteful blowdown—cuts water treatment costs. Impurities are trapped in sedimentation chamber and eliminated in concentrated form.

ELGIN ECONOMICAL WATER CONDITIONING

ASK FOR
NEW BULLETIN 610
"ELGIN WATER CONDITIONING"
GIVING FACTS YOU NEED.

SOFTENERS • CHEMICAL TREATMENT • FILTERS • BOILER WATER CONDITIONING

Supplying authoritative information on plant engineering—news of power and mechanical equipment, management, maintenance, industrial practices and developments, and associated subjects.

INDUSTRY AND POWER

A Magazine for Plant Engineers and Executives

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Cover Illustration

Plant engineer regulates controls on a new 1055 gpm Worthington combination boiler and heater feedwater pump; this unit is capable of operating at 1785 psi. A 1500-hp, 3600 rpm GE motor is direct connected to the pump through an American Blower hydraulic coupling. This unit has been installed at the Trenton Channel Power Plant of the Detroit Edison as part of a 100,000 kw turbine-generator system.

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TEST WATER HARDNESS

this SIMPLE, FAST, ACCURATE way

TAYLOR TOTAL HARDNESS SET

This new Taylor Set replaces the slow, inconvenient soap test. Make fast, accurate determinations on waters ranging in hardness from 1 to 1400 p.p.m. . . . ideal for checking boiler water or as a control test on zeolite or lime-soda treated waters.

HERE'S HOW SIMPLE A WATER HARDNESS TEST CAN BE . . .

You simply place a 50 cc. sample of the water to be tested in a 250 cc. flask with 2 drops of Taylor Hardness Indicator and 1 cc. of Taylor Hardness Buffer. At this point the sample will be red. Add Taylor Hardness Reagent from a burette until the red color changes sharply to blue. Multiply the burette reading in cc. by 20 and ...

There's the Value!

Write For Complete Information

Each Taylor Total Hardness Tester is sold complete . . . includes all necessary equipment and reagents. Write direct for prices and additional information. Also ask for the Taylor Handbook, "Modern pH and Chlorine Control".

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Apropos of—

The Whole

DIVIDING to conquer has become an accepted procedure whether you're a scientist, a military strategist, an engineer, a manufacturer, or a publisher. Any given task, regardless of its field, is much easier to accomplish when it is broken down into its component parts and each part treated as an individual job.

When this step-by-step attack is planned, there is one major difficulty —the objective, or the *whole*, may be lost in the shuffle of completing the individual tasks.

Here at INDUSTRY AND POWER we divide the magazine into jobs that have been sized for easier, more efficient completion. In order to make our magazine of peak interest and value for the engineers and executives in leading industrial plants, it is necessary for us to cover regularly the newest developments and improvements in a wide variety of plant functions. Among them are buildings and service facilities, plant equipment and machinery, power and mechanical services, electrical equipment, power transmission, materials handling, planning and research, supervision, and miscellaneous responsibilities that concern inspection, lubrication, traps, tools, and valves. Because our readers need and have requested interpretative editorial coverage of new industrial legislation, that feature, too, will soon become a regular part of INDUSTRY AND POWER.

Thus, our expanding editorial department contains the men who are specialists in these fields. This high specialization assures you of finding the best and most authoritative industrial and power information in INDUSTRY AND POWER. Simultaneously, though, the organization of INDUSTRY AND POWER is geared to the *whole*.

The executive and production departments work closely with the editorial department to bring about a co-ordination which plans the entire magazine from page to page. The circulation department joins this cooperative circle to make sure that INDUSTRY AND POWER is going to the right plants and to the right individuals in each plant. Our promotion department finds its niche in this over-all picture through a continuing effort to build reader interest and bring our advertisers and readers closer together. That's why you can start with page one of any issue of INDUSTRY AND POWER and find the interest factor constant all the way through the magazine.

Most of you are familiar with our Reader Service Department which is always ready to help you translate your interest into action. Through this service you can obtain tear sheets or reprints of the articles which are of most interest to you. You can solicit the assistance of this department in obtaining for you copies of new bulletins and booklets, additional information on advertised products, and more details on any process or equipment which may be described editorially.

It's the concept of the *whole* which is spearheading the expanding influence of INDUSTRY AND POWER and making it your favorite magazine.

M. J. Sanders

Exec. Vice President

QUAKER HOSE LASTS FIVE TIMES AS LONG

Hundred degree temperatures and plenty of twisting, crushing and abrasion were killers to air hose in a Texas installation. The usual air hose lasted only two or three weeks.

Then QUAKER Blue Devil Air Hose was connected to the compressors. The result! Seventeen weeks of continuous, rugged service and QUAKER was still on the job. Life expectancy of this hose . . . at least 25 weeks!

Performance like this is typical of QUAKER Hose throughout industry—and that's why QUAKER Hose is standard equipment in leading plants throughout the country.

QUAKER'S full line of pre-tested hose meets every industrial requirement.

BELTING FOR LOWER-COST HANDLING

Regardless if you are moving bulk materials or package goods, there is a QUAKER Conveyor Belt to do the job.

PACKING WITH THE POSITIVE SEAL

QUAKER Packings are engineered for every industrial application—for pumps, compressors, water, air and steam lines.

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QUAKER RUBBER PRODUCTS

custom made for every industrial use

NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You Are Interested.

301—D-C REGULATOR PROVIDES CONSTANT VOLTAGE

The Superior Electric Company has introduced a unit that provides a stabilized and regulated source of variable d-c voltage from a-c power lines. Operation is from a 95 to 135 volt, 60

cycle, single phase alternating current line and delivers a direct current output that is variable from 0 to 30 v. The allowable output current available at any voltage setting is 15 amp.

D-c output voltage is stabilized regardless of a-c line voltage fluctuations, and the output voltage remains constant although the load may vary. Stabilization and regulation are given as 0.25% for an output setting between 6 and 30 volts. Rms ripple voltage does not exceed $\mp$ 0.1 volts.

302—SEPARATOR HAS FACTORY MUTUAL APPROVAL

Announcement has been made by the Eriez Mfg. Company that three magnetic separators for the textile industry now bear the Associated Factory Mutual Stamp of Approval. They are the only approved permanent magnetic separators on the market.

The magnetic pulley, magnetic hump separator, and spiked apron magnets are fully sanctioned for installation in

textile and bat-making plants. The approval also covers the use of the unit in conventional textile fiber opener-picker lines as well as in direct feed lines in which fiber passes directly over spiked aprons to feeders, garnets, and cards. Approvals cover the magnetic separators of plate or pulley types in vertical or horizontal opener lines with direct-feed spiked apron installations.

303—GASOLINE HAMMER HAS HOLLOW DRILL

Syntron Company has announced the addition of a self-rotating, hole cleaning gasoline hammer rock drill to their line. The new rock drill utilizes a single cylinder engine which drives two pistons, one piston actuating the fly-

wheel magneto and cooling fan, and the other piston striking directly on the shank of the drill steel. Rotation of the hollow drill steel and bit is accomplished by a spirally splined piston and ratchet.

Exhaust gas is forced through the hollow drill steel and blows the cuttings out of the hole, to a depth of approximately 24 in. For deep hole drilling—8 or 10 ft—an auxiliary gas engine-driven blower is hose connected to the hammer to boost the pressure.

The hammer uses standard 1 in. x 4¼ in. shank hollow drill steels and detachable carbide tipped drill bits of sizes from 1½ to 2 in. dia.

304—PLATE SLING IS ADJUSTABLE

An adjustable plate sling, to handling steel plates in 4, 5, or 6 ft widths, has been designed by Woodhouse

Chain Works. Adjustment is made by locating the heat-treated alloy hook in different end links which permits constant maintenance of 45° chain leg angle and prevents overloads. This adjustable feature eliminates the necessity of changing slings on warehouse cranes to accommodate various plate widths. Consequently, substantial savings in man-hours are effected, and the number of slings normally stocked is reduced. Safe working capacity is 8,800 lb.

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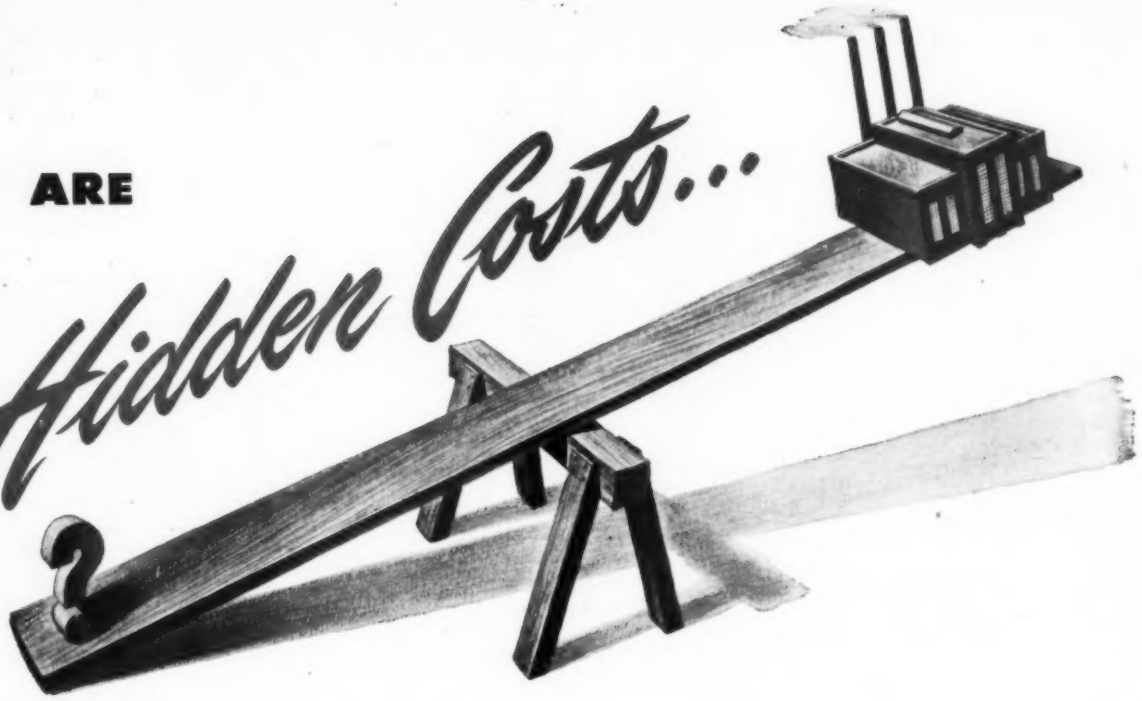
ARE

Hidden Costs...



Keeping Your Plant Efficiency Out of Balance?

Today, as always, costs (hidden or otherwise) are a prime factor in shaping plant operating efficiency. And it's obvious that when efficiency sags, plant operating costs go out of balance. How, then, can *you* best control this "economic see-saw"?

Since water conditioning is a necessary part of efficient plant operation, why not seek ways to make every dollar work harder—with the use of a *correct* water conditioning service designed to help you keep your plant functioning on the profit side year in and year out.

If the results you are presently obtaining are not entirely satisfactory, let us explain how the BETZ specialized water conditioning service can benefit you. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

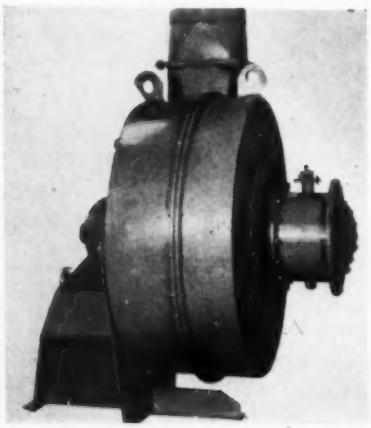
(Continued from page 8)

Hooks are so designed that the full rated load can be lifted on the points.

The new adjustable plate slings may be secured from The Woodhouse Chain Works and Round Associate Chain Companies, which are: The Bridgeport Chain & Mfg. Co., Bridgeport, Conn.; The Cleveland Chain & Mfg. Co., Cleveland, Ohio; Round California Chain Co., So. San Francisco and Los Angeles, Cal.; and Seattle Chain & Mfg. Co., Seattle, Wash.

305—VOLUME BLOWERS DEVELOP HIGH PRESSURES

The North American Manufacturing Company has recently added seven new blower sizes to round out its line of blowers known as the "300" Series. The new additions are large volume, low pressure type and come in either



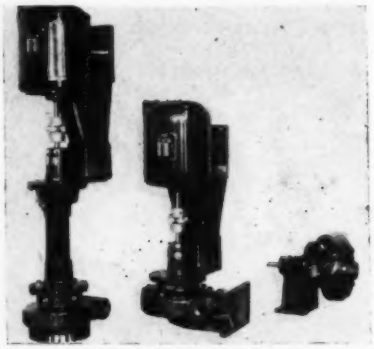
single or two-stages, with either direct or v-belt connection between the motor and blower impellers through a jackshaft.

Four ounce blowers give 4000 and 4700 cfm with 7½ and 10 hp 1750 rpm motors respectively. Eight ounce blowers give 2480, 4250, and 4800 cfm with 10, 15, and 20 hp 1750 rpm motors. Two blowers with 50 and 60 hp 3600 rpm motors give 6000 and 7500 cfm respectively.

These blowers are said to be vibration free and offer long service. Cases and bases are fabricated steel plate, and the well balanced impellers are fabricated aluminum. The discharge may be ordered in several positions.

306—COOLANT PUMP HAS NEMA BASE

A full line of centrifugal coolant pumps—all conforming to Joint Industry Conference standards and adaptable for any NEMA motors—are being offered by the Pioneer Pump and Manufacturing Company. The assembly is a submersible type, designed for installation inside the coolant tank. Normally it rests directly on the bottom of the



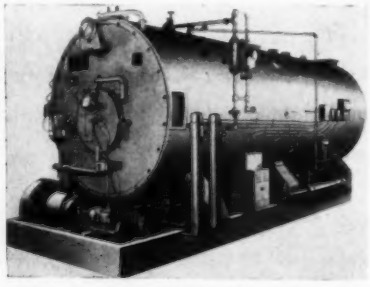
tank or reservoir, but tank brackets and flanges facilitate mounting on the edge, side, or top.

No auxiliary inlet piping is required. The assembly is built for various types of connections to the driving unit and may be operated in a horizontal position or vertically if desired.

307—PACKAGED GENERATOR COMES COMPLETE

Announcement has been made by the Ames Iron Works of an addition to their line of automatic packaged-type units, which will develop 500 hp. This generator is available in pressures from 15 to 200 psi for oil or gas firing. In areas where both oil and gas are available, oil-gas combination units may be used to take advantage of varying seasonal fuel costs.

The unit is furnished complete, ready for installation on boiler room floor, as are 18 other sizes from 10 through 400 hp. When connected to steam, water, fuel, electric lines, and stack,



they are ready for operation. The only foundation required is a level floor of sufficient strength to carry the load.

Furnace and tubes are arranged to permit a smooth flow of hot gases over all heating surfaces. Steam generation is quick, efficient, and at low cost.

308—FLUORESCENT MAGNIFIERS AID PLANT LIGHTING

Industrial Products Company has announced two new industrial magnifiers, equipped with fluorescent lighting, designed for assembly workers, inspectors, toolmakers, machinists, and other engaged in close work. Scientifically focussed, shadow-free fluorescent light, magnify the work area through a high quality 5 in. dia lens.

The bench type has a steel base, two adjustable friction arms and two swivels (one at base and one at top of lens frame) permitting adjustment to any desired position.

The portable type is similar to the bench model except that it is fitted with a comfortable hardwood handle in place of the arms and base. This

style is practical for use inside of machines and in other out of the way places.

Both units are furnished complete with 6 ft of rubber cord and ballast plug, ready for use in any 110-120 volt, 60 cycle electrical circuit.

309—NEW LIGHT TRACTOR CAN BE RIDERLESS

A new towing tractor, which need not be ridden to be operated, will tow

ten tons on trailers over a level course at speeds from 1 to 6.5 mph, has just been announced by the Industrial Truck Division of the Clark Equipment Company. The driver can operate the machine while walking on either side so he can facilitate order-selection work. A combination clutch-and-throttle control bar extends across the tractor width, and by moving the bar forward, the tractor and train will move a few feet at a time.

The train weight acts as a brake, and permits the driver maximum time to pick and place items on the trailers. If positive braking is necessary, the driver simply touches a foot to the brake bar at the rear of the driving plat-

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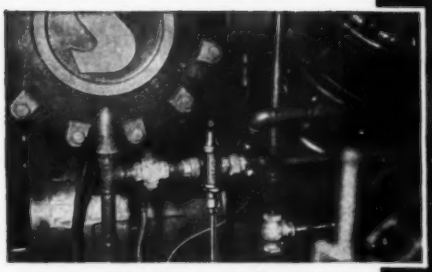
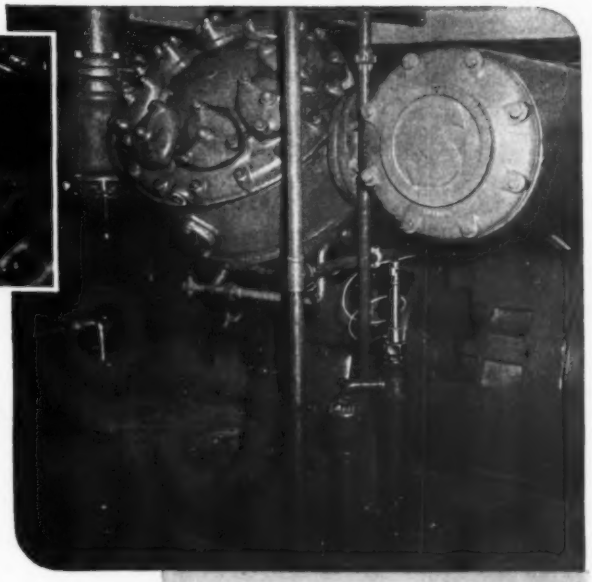
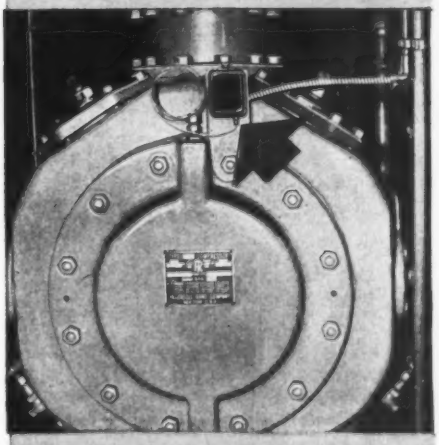
2/3 OF COOLING WATER *Saved!*

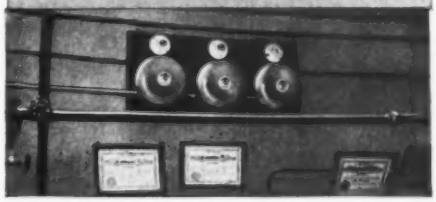




The Engineer at The Harvey Metals Corp. is well pleased with the Sarco TR-21 cooling control on this big compressor in Chicago. And so is the management because up to ⅔ of the metered water used for cooling is now saved. The engineer says: "With several thousand dollars tied up in a compressor, you are going to open up the cooling line wide and play safe, unless you have cooling control. Yes, we use the warm water too, but it used to overflow the hot well continually."



Bell rings and red light flashes when compressor cooling water gets too hot.



OTHER SARCO COOLING CONTROLS

When you merely want to protect the engine or compressor and don't care about the water there are several Sarco combinations available. You can put a high limit control on the compressor which will flash red lights and ring the gong when danger is near. Or you can just put on a Sarco Control that shuts down the compressor when the water gets too hot. For smaller compressors and vacuum pumps, the Sarco TR-40 Cooling Control is inexpensive, goes into the line like a T and is saving up to 50% of the water on many jobs.

ASK FOR BULLETIN No.700 ON SARCO COOLING CONTROLS

273

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

YOU'LL SAVE MONEY WITH A SPREADER

YOU'LL SAVE EVEN MORE WITH A . .

View of a recent Perfect Spread Stoker installation consisting of four traveling grate spread stokers, 10' wide x 14'3" long. They are installed under Wickes four drum bent tube boilers and have a continuous capacity of 60,000 lbs. per hour. Consulting Engineers were Albert Kahn, Associates.

Only Perfect Spread Stoker assures even coal distribution . . . won't clog on wet coal . . . has a cinder return system that works . . . adjustable overfire air

THERE'S NO GUESSWORK about it. You'll save real money — important sums regularly — with a spreader stoker. It enables you to burn a wide range of coals, including the cheaper, high ash coals, with top efficiency. No more paying premiums for coal when you have a spreader stoker. You utilize the coals that are attractively priced in your locality.

IN SPREADER STOKERS—IT'S PERFECT SPREAD —FOR MOST STEAM AT LEAST COST

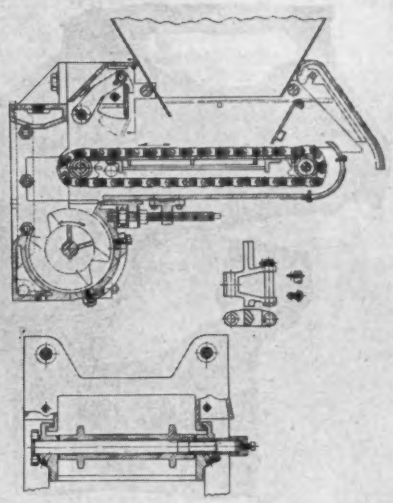
Exclusive features, unique in design, make the Perfect Spread Stoker the most efficient spreader that has ever been built. First and foremost, its feeder assures positive, continuous and accurate coal feed . . . it won't clog even when coal is wet. Next, the spiral overthrow rotor is unmatched for *even* coal distribution. And the engineered cinder reinjection and adjustable overfire air system are final assurance of superior fuel combustion.

Perfect Spread Stokers are made in both continuous discharge, dumping and stationary grate types. Coal feed is adjustable from 50 lbs. to 7,500 lbs. of coal an hour per feeder. Capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon on next page for full information . . . and be sure to call in your Consulting Engineer for recommendations regarding your requirements.

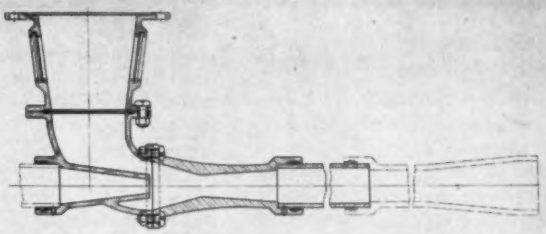
ERSTOKER *BUT* . . . .

. . PERFECT SPREAD STOKER

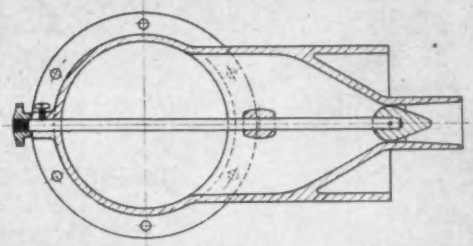
AMERICAN ENGINEERING COMPANY



NON-CLOGGING CONVEYOR FEEDER: Coal enters feeder from hopper, and is conveyed positively, continuously and uniformly forward. Coal is not fed in slugs.



ENGINEERED CINDER REINJECTION SYSTEM: An extremely efficient system; all fittings of alloy iron. Air driven through the venturi section sucks cinders into the air stream for return to the furnace. A *separate* line is provided for each cinder drain point.



ADJUSTABLE OVERFIRE AIR SYSTEM: Most of the overfire air enters furnace through nozzles in side or rear walls. Each nozzle is a separate venturi-type unit and *individually* adjustable.

WHERE UNDERFEED STOKERS ARE INDICATED YOU CAN'T BEAT THE TAYLOR STOKER

Taylor Underfeed Stokers of adequate grate area deliver over 90% of the ash to the ashpit . . . and most of the remainder is collected in boiler passes without expensive dust recovery equipment.

Shown at right is a 7-Retort, 25 Tuyere Taylor Stoker. It provides low-cost steam for plants of moderate size. The principles of combustion are identical with those of the high capacity Taylor Stokers that are the standard for central stations and large industrial plants.

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

Other AE Products are Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Car Shakers, Car Pullers.

American Engineering Company
2406 Aramingo Ave., Philadelphia 25, Pa.

Gentlemen: We are interested in "most steam at least cost." Send me full information about ..... Perfect Spread Stokers; ..... Taylor Stokers.

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

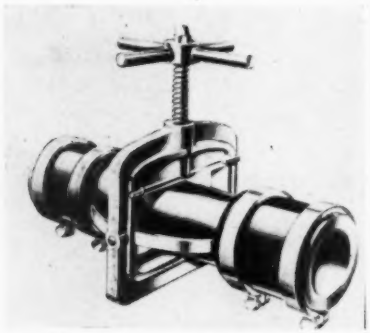
(Continued from page 10)

form. The parking brake is actuated by electricity and is controlled by a toggle switch on the instrument panel.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

310—PINCH VALVE HAS NON CLOGGING FEATURE

A pinch type flexible valve which controls the flow of many highly abrasive and corrosive materials comes in three types: ½ to 2½ in. for mounting over the ends of pipe; flanged end, 1 to 12 in.; and diaphragm motor 1 to

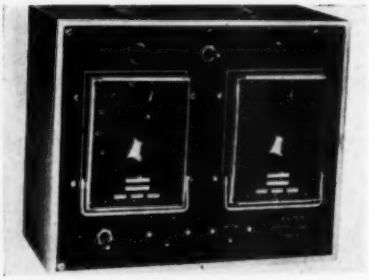


10 in. The valve body has no internal parts or obstructions, full pipe capacity, and absolute bubble tightness. A smooth bore minimizes incrustation and permits cleaning by tapping or flexing with a mallet. A throttling position is possible without undue cavitation because of streamlined design.

Construction allows for rapid opening and closing without fear of structural failure. Specially impregnated cloth is wrapped around a ¼ in. rubber tube followed by layers of pure gum. The entire unit is wrapped in acid resisting covering. The flanges are built on during the construction of the wrapping, and later vulcanized and cured in ovens. Flexible Valve Corporation.

311—DUAL TIMER WORKS AUTOMATIC

"Tandem Recycling Timer", manufactured by Industrial Timer Corporation, is a new device having two individual timing elements—each able of controlling a specific operation in a single housing. When the timer dials are set to the respective time intervals required, each cycle of operation will follow the other continuously in regular sequence. Two successive production operations that require, for example, four minutes and two minutes

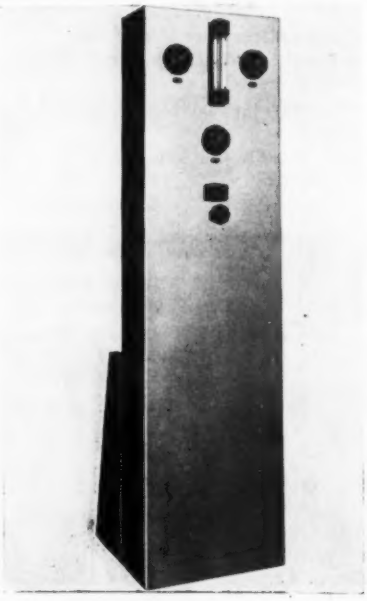


respectively for their completion can be controlled. The sequence can be maintained indefinitely, no adjustments being necessary until new time intervals are required.

Complete control cabinet measures 11½ x 9 x 7 in., and contains two sockets into which the timing elements are plugged. The contact circuit of a relay is unpowered, permitting application of the particular voltage and current necessary for test or production. Load relay contacts are rated 20 amperes at 115 volts a-c noninductive. ON and OFF toggle switch, load control switch, and pilot lamp are integrated with other components to give an extremely compact, clean-cut, portable assembly; and the ease with which timing elements can be changed, simplifies the operation.

312—CHLORINE GAS FEEDER IS SAFE AND ACCURATE

A chlorine gas feeder has been designed by Builders-Providence, Inc., to insure completely safe and highly accurate operation. The unit has been thoroughly field tested. Numerous industrial installations have been made that are metering chlorine gas and producing closely controlled concentrations and have improved the control of slime

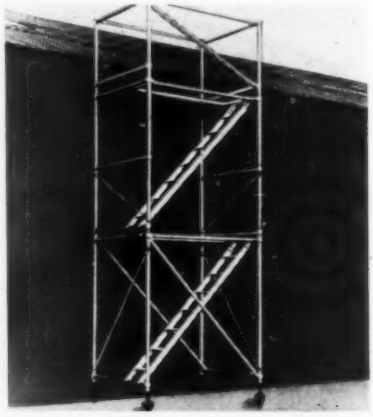


and mussel growth. A positive and accurate chlorine rate indicator with direct reading linear scale assures equal ease and accuracy of readings.

Maintenance due to corrosion is reduced to a minimum because chlorine is controlled and metered in the dry, inert state. The feeder is readily adapted to semi-automatic program, or automatic proportional operation, and conversion from one method of operation may be made in the field.

313—ALUMINUM SCAFFOLD EASILY MANEUVERABLE

A sectional-type aluminum rolling scaffold is announced by The Patent Scaffolding Co., manufacturers of scaf-



folding and other safety-off-the-ground equipment.

Light, easy to erect, and neat in appearance, the aluminum scaffold is ideal for many types of overhead and sidewall work such as painting, cleaning, office building maintenance, and to install and repair lighting fixtures.

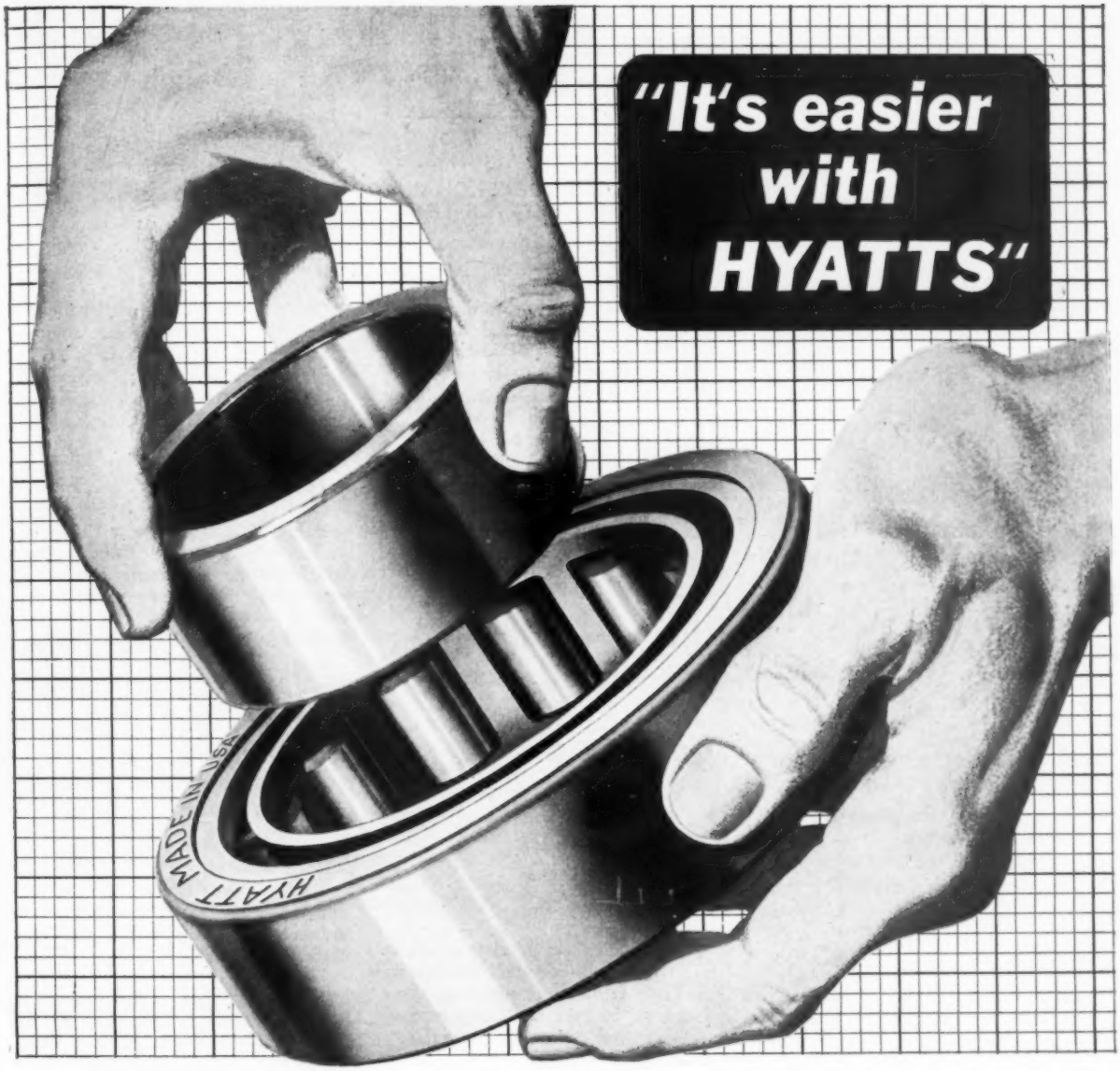
The scaffold is offered in two types —stairway and ladder. All the parts, except casters and platforms, are made of light, durable aluminum alloy. Scaffolds are supplied in one or more sections, with guard rails. The bottom section is 7 ft 3 in. from ground and each additional section is 6 ft 8 in. high. Base dimensions are 4 ft 6 in. x 6 ft. Two types of 5 in. steel casters are available—a non-elevating and an adjustable type with a steel screw providing additional height.

Frames for intermediate sections slip over a sprocket in the lower section, and the joint is secured by a hinged pin for extra safety. A spring lock secures horizontal members.

314—INDUSTRIAL RUBBER MAT IS SKID RESISTANT

A super-tough oil-resistant rubber mat, just announced by Patterson-

(Continued on page 16)



BY VIRTUE of their interchangeable parts —as this photograph of a Hyatt Hy-Load Roller Bearing shows—we make it easier for the machine builder to install Hyatts without selective fitting.

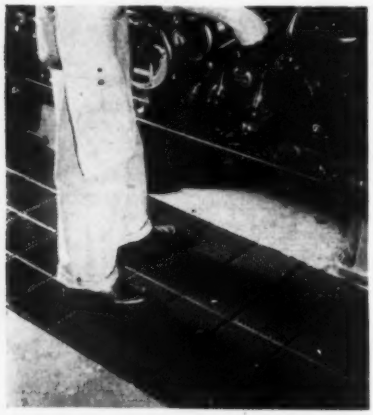
But ease of assembly and disassembly is only part of the story. Add to this easier machine operation, design simplification and longer life with Hyatts and there's your answer to why they are universally preferred.

That's why it pays to design Hyatts into the machines you build or to look for Hyatts in the specifications of equipment you purchase. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

(Continued from page 14)

Ballagh, has many industrial uses for operators of drill presses, lathes, and shop machinery in addition to accounting and engineering departments. Several mats can be laid together to cover



large working areas, or they may be cut apart to surface stairs and small areas. Pattern design features large rubber blocks with a non-skid surface. The mat is grooved on the underside to prevent slipping under wet or oil conditions and is designed for very severe service. The over-all size of the mat is 32 x 32 in.

315—SIDE-SHIFTER PERMITS LOAD-POSITIONING

The Yale & Towne Manufacturing Company has announced the design of a hydraulically operated side-shifter attachment for the Lift King and Work-

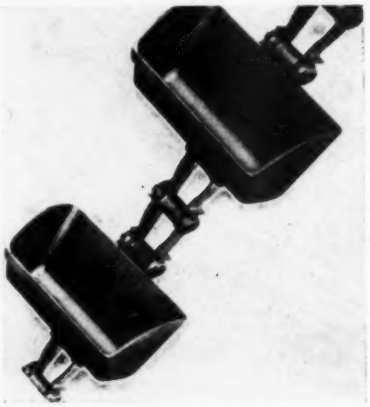
saver fork trucks. The device shifts the forks as much as four in. right or left of center. It is possible to spot loads in odd corners, close to walls, near pillars, or in other confined transfer and storage areas. The side-shifter is easily removed and permits installation of such accessories as drum handlers, pushers, rotators, keg handlers, clamps, or other attachments for handling a wide range of load-types in quantities.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

316—ELEVATOR BUCKET CHAIN INCREASES SERVICE LIFE

Bucket elevator chains made of a heat treated alloy steel, have been developed by the Beaumont Birch Company to improve performance and life expectancy of conventional malleable iron chains.

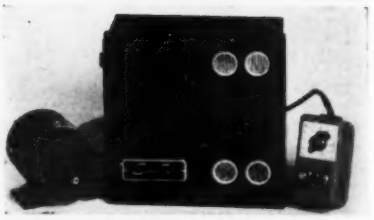
Design features include: projecting guards to deflect material from chain joints; slotted boss ends to prevent pin from rotating and protect cotter pin from wear; connecting pins made of heat treated alloy steel have a centerless, ground finish that greatly reduces friction; a single link barrel cast integrally



with side bars made of alloy steel; a larger barrel; and special attachments. Links now fold into place on the sprocket or traction wheel and maintain almost steady contact throughout rotation, minimizing friction and wear on the inside and outside surfaces of the link barrel.

317—MOTOR SPEED CONTROL IS STEPLESS

Simplified thyratron type motor speed control system that operates d-c motors from an a-c line is a new addition developed by Servo-Tek Products Co. Shunt wound type 115 volt motors of from one-thousandth to one-tenth hp may be controlled over a speed range of better than 50 to 1 with nearly constant speed versus torque regulation. A physically identical model is available for operation from the 220 volt line to control d-c motors of the shunt wound type up to one-sixth hp. Speed range is identical for either unit. Full wave vacuum tube rectified a-c is filtered and applied to the motor field and eliminates the field weakening prob-



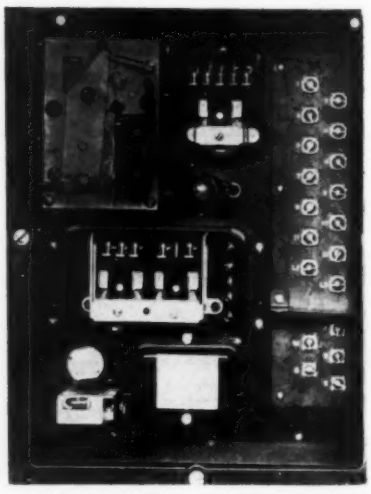
lem. Controlled variable voltage is supplied the armature to vary motor speed.

The power supply cabinet made as a separate unit and mounted at any convenient point, measures 8 in. x 8 in. x 4 in. The power supply chassis is affixed to front hinged cover and is easily removed by means of clip type hinges.

The control station case, mounted near the motor, contains the speed control potentiometer, pilot light, and idle switch. The idle switch allows the operator to stop and start the motor without changing the speed setting. Speed change is accomplished by a volume control type potentiometer.

318—FOOL-PROOF DETECTOR PREVENTS EXPLOSIONS

Flame detector that eliminates the limitations in electronic safeguards for many processes where oil or gas fired burners are used has been developed by Minneapolis-Honeywell Regulator Company. The device operates on flame rectification principles and makes use of the fact that either flame, or a photocell sighted at a flame, is not only capable of conducting an electric current, but rectifying an alternating current as well. The new system applies alternating current to either a flame-



electrode immersed in the flame or to a photocell sighted at the flame.

The new device provides maximum safety and meets the latest requirements

(Continued on page 120)

DON'T BLAME YOUR PAINTING CONTRACTOR

You've often seen unsightly rust stains from metal sash on the adjacent brick and stone surfaces. You need never blame your painting contractor for unsightly stains caused by rust! You can *prevent* rust . . . and at no extra cost . . . simply by specifying RUST-OLEUM as the *shop coat, primer and finish coat* on all metal rust can attack.

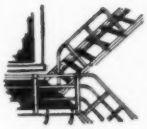
But, specify Rust-Oleum in the *first stages* . . . when design, engineering and contracting take form . . . before actual delivery of material for the job. Rust-Oleum costs no more than quality material you may now be using . . . and is easy to apply at no added expense.

Rust-Oleum is tested and proved by a host of nationally known users. Rust-Oleum *stops* and *prevents* rust! RUST-OLEUM protects metal from rust with a tough, pliable film that dries to a firm finish. Rust-Oleum defies sun, rain, snow, salt air, smoke, fumes and other rust-producing conditions . . . and adds longer life wherever it is used. Girders, plates, stacks, gutters, roofs, tanks . . . every metal surface can be protected surely, safely and *economically* with RUST-OLEUM.

Rust-Oleum *beautifies as it protects* because it is available in many attractive colors including aluminum and white. Rust-Oleum can be applied to already rusted surfaces with minimum preparation . . . *it is not necessary to remove every appearance of rust!*

So, take the sure way to stop rust. Specify Rust-Oleum on all rustable metal, inside or out. It costs less ALL WAYS to do the job right.

Rust-Oleum is stocked and sold by leading industrial distributors in all principal cities of the United States and Canada. See Sweets for complete catalog and nearest source of supply, or write us direct for complete information.



Architects, Engineers, Builders

If you have a client with a rust problem, and would like a free survey and recommendations, send his name and address on your business stationery. A qualified Factory Representative will arrange this FREE Service, and it includes a trial size of Rust-Oleum for specific test purposes. These's no obligation on your part. Write today.

**Names on request*

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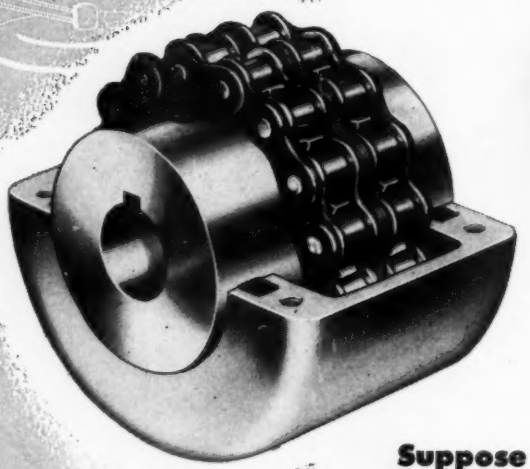
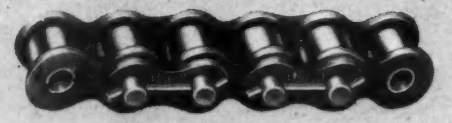
Wherever You are...

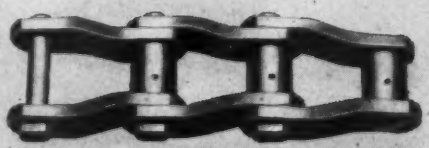
UNION CHAIN IS NEAR BY





UNION ROLLER CHAIN

UNION SILENT CHAIN



UNION HEAVY DRIVE AND CONVEYING CHAINS

Suppose you need UNION Roller Chain or Silent Chain Flexible Couplings . . .

. . . for replacement or for a familiar application. Just phone or write to your nearest Union Chain stock carrying distributor as listed on the facing page, and the chances are good that he can ship immediately.

. . . ***or suppose you need*** engineering advice on the proper use of flexible couplings for the joining of two shafts of the same or different diameters in such a way as to allow lateral movement of either shaft and compensate for a slight misalignment of the shafts. Then you should get in touch with the nearest Union Chain district representative as listed on the facing page.

You will receive competent, experienced counsel, since Union Chain manufactures all types of steel drive chains and is thoroughly accustomed to solving power transmission problems for its customers. We will welcome your inquiry.

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Lima, Ohio

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Toledo, Ohio

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C. F. Dagwell Co.
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Oklahoma City, Okla.

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Eugene, Oregon

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Industrial Machinery & Supply Co.
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La Grande, Oregon

Industrial Steel & Supply Co.
North Bend, Oregon

Klamath Machinery Co.
Klamath Falls, Oregon

J. W. Minder Chain & Gear Co.
307 S. E. Hawthorne Blvd.
Portland 14, Oregon

PENNSYLVANIA
Ace Bearing Co.
1120 Wyoming
Scranton 1, Pa.

Bush-Brenner, Inc.
370 N. George St.
York, Pa.

Industrial Supply Co.
451 E. Broad St.
Hazelton, Pa.

Industrial Transmission Machinery, Inc.
209 N. Third St.
Philadelphia, Pa.

PENNSYLVANIA
F. R. Magill Co.
44 McKnight St.
Pittsburgh 20, Pa.

Maximon Machine Co.
801 N. Logan Blvd.
Altoona, Pa.

Reilly Bros. & Raub
44 N. Queen St.
Lancaster, Pa.

SOUTH CAROLINA
Southern Mill Supply Co.
Summerville, S. Carolina

TENNESSEE
Hoyt N. Payne Co.
P.O. Box 942
410 E. Depot Ave.
Knoxville, Tenn.

Tennessee Machinery, Co.
113-119 Third Ave., South
Nashville 3, Tenn.

Tipps Engr. & Supply Co.
260 N. Front St.
Memphis, Tenn.

TEXAS
Allied Belting & Trans. Co.
2614 Sylvan Ave.
Dallas, Texas

Beacon Supply Co., Inc.
1825 Washington Ave.
Houston 10, Texas

Clowe & Cowan, Inc.
401 Harrison St.
Amarillo, Texas

El Paso Machine Works, Inc.
1600 E. 44th St.
El Paso, Texas

Lloyd Electric Co.
511 El Paso St.
San Antonio, Texas

VIRGINIA
Blue Ridge Hardware & Supply Co.
Bassett, Virginia

Mill Supplies Corp.
South Norfolk, Va.

WEST VIRGINIA
Smith Steel Supply Co.
150 Peninsula St.
Wheeling, W. Va.

WISCONSIN
Dale Industrial Supply Co.
Wausau, Wisconsin

Richard E. Ela Co.
744 Williamson St.
Madison, Wisconsin

F. D. Huber Co.
713 South Tenth Street
Milwaukee 4, Wisconsin

The Union Chain and Manufacturing Company **Sandusky, Ohio, U.S.A.**

TRANSMIT POWER
UNION CHAINS
CONVEY MATERIALS

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Vertical Boiler (A) Two-page folder contains information on a new vertical boiler for high pressure steam from 3 to 15 hp capacity. Specifications and outline dimensions are shown for five boiler sizes. York-Shipley Inc.

Boiler Caps (B) New 4-page bulletin entitled "New Life for Old Boilers" describes how old boilers can be rejuvenated at low cost, with necessary tube replacements, repairs, and hand hole caps. Several actual installations are illustrated. Key Company.

Condenser Tubes (C) Illustrated bulletin discusses the economical choice of appropriate tubing for specific service conditions in heat transfer units and for easy fabrication in heat exchanger apparatus. Methods are offered to help solve numerous field problems. Specifications and data are offered in a table on carbon, low chromium, intermediate chromium, nickel and stainless steels. The Babcock & Wilcox Tube Company.

Packaged Boiler (D) Attractive, 12-page, four-color catalog is available that illustrates various sizes of self-contained, oil, and gas fired steam boilers, ranging from a 15 to 500 hp and 15 to 200 psi. Included in the catalog is a diagrammatic cross-section which shows the four pass design incorporated in these boilers. Numerous photographs of actual plant installations are shown. Cleaver-Brooks Co.

Self-contained Boiler (E) Just released bulletin covers a complete line of self-contained steam generators that range in capacity from 20 to 500 hp, at 15 to 200 psi operating pressures. Specifications are included for all units for gas and oil firing, along with conventional outline dimensions. Edge Moor Iron Works, Inc.

Steam Separators (F) Printed in two colors, this bulletin illustrates and covers a complete line of steam separators for 50, 125, and 600 psi operation. Each item is covered individually with specifications and outline dimensions. Selection and ordering data is included. The Swartwout Company.

Air Ejectors (G) Operating principles of steam jet air ejectors are explained and illustrated in a new 12-page catalog. Ejectors are classified as to operating pressures. The theory of inter and after condensers is covered. Useful engineering data is also available. Condenser Service and Engineering Co., Inc.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Diesel Generator (H) Factual 12-page bulletin describes a powerful, single acting, two-cycle diesel engine that has a 29 in. bore and 40 in. stroke. Sizes range from 5 to 12 cylinders with ratings from 3570 to 8500 hp. General information includes: engine design, low-cost fuel requirements, scavenging system, lubrication and piston cooling system, and reversing gear arrangement. Nordberg Manufacturing Co.

Diesel Quiz (I) Phamphlet describes the features, characteristics, and application of Diesel engines in questionnaire format. The "Quiz" provides simple, easy-to-understand answers to 17 basic questions on design and operation of Diesel engines. Detroit Diesel Engine Div. General Motors Corp.

Battery Maintenance (J) Informative new three-page bulletin, entitled "Instructions for the Maintenance of Gould Batteries for Diesel Engine Cranking Service" presents 14 valuable battery maintenance procedures covering battery care from initial installation through complete charging operations. The first section lists five safety rules, second tells how to install batteries to prevent shunting, while other sections give valuable information on battery cleaning, compartment ventilation, cell identification, and record keeping. The bulletin is punched for easy insertion in a three ring notebook. Gould Storage Battery Corporation.

WATER AND LIQUID TREATMENT

Chlorine Reference (K) Attractively printed two-color 44 page bulletin is a quick reference technical manual that gives basic help on containers for chlorine shipment, proper service tools, equipment, and accessories. The second section is devoted to a review of chlorine properties such as: enthalpy, vapor pressure, density, specific volume—in all there are eight tables and charts. Diamond Alkali Company.

Boiler Water (L) New 24 page booklet, in color, on water treatment and equipment covers the principles and fundamentals of providing trouble-free water in boiler plant operation, for the prevention of scale, pitting and general corrosion, for producing pure, dry steam, and to avoid caustic embrittlement. A feature of the booklet is a two page diagram showing the number of tests, what tests to make, and where to make them in a water and steam cycle-power plant layout. Dearborn Chemical Company.

Chlorine Control (M) Revised handbook edition of Modern pH and Chlorine Control" describes the factors to control pH chlorine and phosphates in boiler waters. The new booklet contains photographs and general instructions for the application of equipment in determining concentration tests. W. A. Taylor and Company.

Chlorine Dispenser (N) New eight-page illustrated catalog describes an improved line of dispensers, that accurately, safely, and automatically meter, control and dispense chlorine. Self-contained cabinet-type units have capacities ranging from a minimum of one lb to a maximum of 1200 lb of chlorine per day. Fischer and Porter Company.

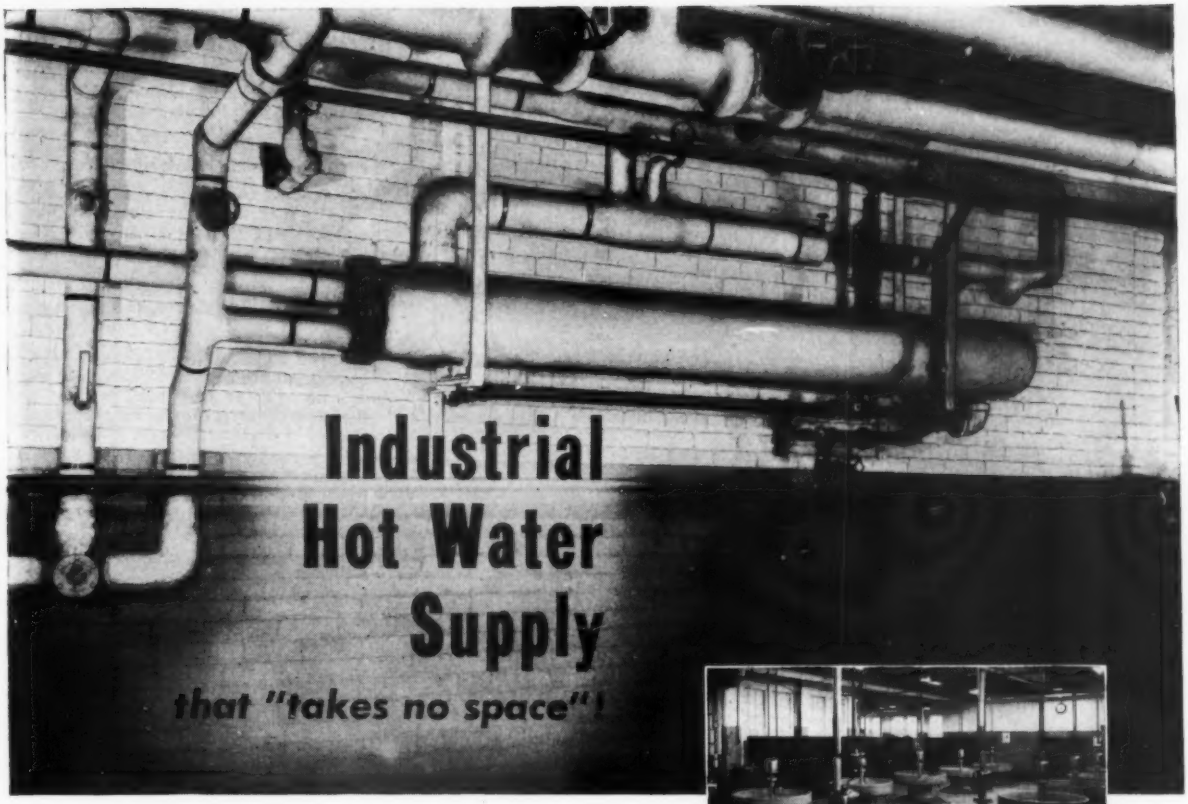
ELECTRICAL EQUIPMENT

Circuit Breakers (O) General distribution eight page, illustrated, folder covers the development, production, and advantages of a non-thermal, fully automatic magnetic panelboard circuit breaker. Graphs, schematic diagrams, engineering drawings, cut away views, ratings, and data on application, operation, and construction are included. Heinemann Electric Company.

Voltage Regulator (P) A pole-type regulator designed to correct rural low voltage conditions and improve service is described in a new 12 page bulletin. Important features of the regulator that result in trouble-free performance are shown, and the reasons why it is simple to mount, operate, and maintain are given. Allis-Chalmers Mfg. Co.

Explosion-Proof Motors (Q) Bulletin, expressly for engineering, produc-

(Continued on page 22)



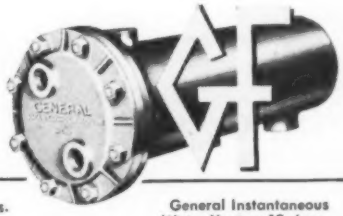
This General Instantaneous Water Heater installation at Nicholson File Company supplies 96 gpm at 125° F. for 12 Bradley wash fountains in the Cutting Dept. washroom.

Think of all the headaches avoided by this compact, simple G F hot water heater that supplies 96 gals. of 125° water a minute. No space problem, because it's mounted on the wall . . . out of the way. No major construction is involved either, because it has no tank, no complicated piping. Installation required minimum of planning, minimum amount of work. And the unit is located near the washroom . . . no long runs of piping, no heat waste.

Maybe you have a similar water heating problem that can be solved as economically and as easily. General Instantaneous Water Heaters supply up to 300 gallons of clean hot water a minute through seamless copper tubing . . . 19 sizes, the largest measuring less than 15" by 120". Heated with steam through shell . . . all waterways non-corroding bronze or copper.

Here's the efficient way to boost hot water capacity without building an addition to your plant or crowding your boiler room. Why not get all the details? Send for new Catalog No. 19. General Fittings Co., A-123 Georgia Avenue, Providence 5, R. I.

GENERAL instantaneous water heaters



Products of General Fittings Co., makers of Tankless and Indirect Water Heaters and Heating Specialties.

General Instantaneous Water Heaters 19 sizes up to 300 g.p.m.

(Continued from page 20)

tion, purchasing, and maintenance men, describes and illustrates three classes of explosion-proof motors. Particular emphasis is placed on motor application in such locations where hazardous conditions exist. Motor construction details are provided that illustrate the corrosion-resistance protection. Reference is also made to explosion-proof gearmotors in single, double, and triple reductions. Reliance Electric & Engineering Company.

Rectifier Welders (R) Booklet describes 200, 300, and 400 amp 60% duty cycle, selenium rectifier d-c welders. Included is engineering information on relative power costs, performance characteristics, construction details, electrical characteristics, welding characteristics, dimensions, and weights. Graphs of kva input, efficiency, and power factor at welding currents up to full load are also shown. Westinghouse Electric Corporation.

Light Dimmers (S) File size 12 page bulletin opens with a discussion on the creation of "atmosphere" through the dimming, brightening, and blending of light. Suggested uses are illustrated, and advantages are clearly and understandably stated. Sketches illustrate several of the outstanding features of the equipment. A chart gives standard dimming electrical ratings, approximate dimensions, and weights. The Superior Electric Company.

A-c Regulators (T) Factual ten page bulletin covers numerous basic circuit voltage regulators that are accurate and economical to operate. Design features and performances are given along with specifications of each unit. Sorensen and Company, Inc.

Electric Conduits (U) New 30-page catalog describes and illustrates many types of electrical conduits. First half of the booklet is devoted to rigid steel conduits, elbows, nipples, bondnuts, locknuts, bushings, and insulated bushings. A comprehensive review tells how the steel is fabricated and how it is zinc-treated against corrosion. Flexible steel conduit for branch circuit wiring is available in sizes from ⅜ to 3 in. National Electric Products Corp.

Small Motor Selection (V) Four page booklet explains why there are different types of fractional horsepower motors, and the factors to be considered in selecting the right motor for the application. A tabular form presents the various types of small motors, complete data concerning hp range, speed characteristics, torque, reversibility, bearings, mountings, and application. Typical speed-torque curves for fractional hp motors are included. Westinghouse Electric Corporation.

Synchronous Motors (W) Two-color eight-page bulletin covers high-speed synchronous motors for applications such as driving pumps, grinders, compressors, saws, beaters, fans, generators, conveyors, and mixers. The bulletin contains three typical installation stories, and discusses construction features, mechanical modifications, and direct-connected exciters for the motors. Motor ratings are from 20 to 1500 hp at 60 cycle speeds of 1800 rpm. General Electric Co.

D-c Rectifier Substation (X) Rectifier unit substations, that provide a source of d-c power installed near the load, are described in a 16-page booklet. Component parts of the rectifier substations are explained along with dry-type transformers. The unit can be mounted anywhere in a factory space with no fire or explosion hazard. Metal-enclosed switchgear for both a-c and d-c portions of the substation are shown. Westinghouse Electric Corp.

Safety Switches (Y) Latest information on high capacity interrupter safety switches is contained in a new folder, just released. Arc-quenching action, a new grid pin design which breaks up the arc and thus interrupts heavy loads quickly and cleanly is illustrated by several schematic drawings. Other features described include center-front operation, front fusing, and roller-cam action which throws the switch to full OFF and ON with no possibility of dead-centering. The Trumbull Electric Manufacturing Co.

INSTRUMENTS, CONTROLS, RECORDERS

Control Panels (Z) An 8 page booklet explains how control panels are made and where they are used. All the operations of fabrication are discussed and illustrated such as electric clocks, pressure gages, transformers, name plates, push-button stations, and signal lights. The Hays Corporation.

Draft Gages (AA) Straight line bell and dial bell gages are presented in a factual 12 page bulletin. Each of the principal parts is reviewed and illustrated in a specification style. Outline dimensions are listed for all gages discussed. Ellison Draft Gage Co., Inc.

Combustion Safeguard (BB) An explanatory bulletin on a new combustion safeguard for oil and gas fired furnaces, ovens, boilers, kilns, and other heating equipment, has just been released. The new series incorporates many economy and safety features. Described and illustrated. Wheelco Instruments Company.

MATERIAL HANDLING

Conveyor Units (CC) Colorful bulletin, containing 24 pages, gives detailed information on standardized conveyor units. Specifications on various types of elevating roller, belt, and wheel conveyors, lowering and horizontally conveying sacks, cartons, boxes, and bundles are included along with well illustrated photographs. Standard Conveyor Company.

New Equipment (DD) Recently available lift trucks, cranes, tractors, and other materials handling equipment are described in a new 8-page illustrated folder. A. & A. Machinery Corporation.

Palletless System (EE) New 4-page illustrated bulletin describes a fork truck system of palletless handling. Pictures and drawings illustrate application of the system to transporting and tiering of loads of sacks, cartons, bails, and drums. Elements of the system are presented in an overall inclusive manner that permits application of the system to special requirements of specifis industries. Yale & Towne Manufacturing Company.

POWER TRANSMISSION

Gear Motors (FF) A new bulletin has been issued that describes the major features and illustrates various types of standard fractional and integral gearmotors. Specifications are listed for 30 complete units ranging from 1/20 to 7.5 hp. Janette Manufacturing Company.

Speed Reducers (GG) Informative 16 page brochure presents a complete story of a new torque arm speed reducer line. Full size photographs of mechanism aid greatly in understanding the underlying principles. Detailed instruction explains how to select a reducer from the tables when the speed of the driven shaft and horsepower are known. Dodge Manufacturing Corporation.

Diesel Converters (HH) Multi-color 24-page bulletin covers the inside story of a torque converter, and how it can be adapted to this company's industrial Diesel engines. Numerous applications are covered, such as cranes, tractors, locomotives, petroleum industry, and stationary engines. Performance curves are included. Detroit Diesel Engine Division, General Motors Corporation.

PUMPS AND ACCESSORIES

Multistage Pump (II) 12 important operating features are explained and illustrated in a six page folder. A two page colored cross-sectional detail view of the pump is captioned and direction lines connect each feature. Overall dimensions and specifications are listed for four pump sizes. American-Marsh Pumps, Inc.

Direct Flow Pump (JJ) Six page data sheet gives information on new direct flow pump. Includes information on construction and design, specifications, dimensional drawings, and illustrations. Aldrich Pump Company.

Centrifugal and Piston Pumps (KK) Descriptive data covering numerous types of pumps, together with applications and general information are included in a new 24-page catalog. Condenser Service and Engineering Company, Inc.

Sewage and Trash Pump (LL) Recently developed bladeless sewage and trash pump is described and illustrated in new 16-page bulletin. Information covers design, construction, and operation. Fairbanks, Morse and Company.

TOOLS AND SPECIALTIES

Locknuts and Lockwashers (MM) Specifications and dimensional charts for a new line of locknuts and lochwashers, designed for locking ball and roller bearings on shafts, has just been released in a four page bulletin. Shaft sizes covered are 3/8 to 8 in. Shafting machining data are given in table form

(Continued on page 131)

"HOT UNDER THE COLLAR"

about last winter's fuel bills?

You're probably getting more "heat" out of last winter's fuel bills than you got all winter out of the fuel . . . if your plant had one of those old-fashioned systems that banks the heat uselessly up against the ceiling. You paid for heat, but you didn't get it down at the working level.

Now is the time to do something about fuel savings next winter . . . by pushing the heat down where you need it, with Thermolier Unit Heaters. It's wise to do it right now because you can get Thermoliers and the other materials easily at this season. Skilled labor has the time to do the job just the way you want it. And you're not risking a hurry-up job this fall.

Make next winter a season of heat-saving instead of heat-wasting. Savings with Thermoliers differ, of course, with differences in buildings, but a railroad shop saved 35%; one manufacturer, 29%; and a company operating 50 plants averaged 30%. Your savings may be even larger. Get in touch with Grinnell or your local Thermolier distributor.

THERMOLIER

UNIT HEATING

Construction features that save extra money

Use of plain thermostatic trap, the simplest and least expensive kind of trap, made practical because of Thermolier's exclusive internal cooling leg.

Maximum capacity provided at all times and annoying, destructive water hammer eliminated by built-in pitch of tubes and internal cooling leg which assure continuous drainage of condensate.

Damaging strains caused by expansion and contraction eliminated by "U" type expansion tubes.

Safety and durability assured with leak-proof tube-to-header construction.

Five other important features. Write for Thermolier Catalog.

100th ANNIVERSARY — WHENEVER PIPING IS INVOLVED

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Grinnell Company, Inc., Providence 1, R. I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See pages 42, 43. Complete Steam Generating Units: A Riley unit will reduce your investment costs by reducing building height, by eliminating costs of seals between unit and ash hopper, by eliminating cost of separate ash hopper, by reducing maintenance and increasing efficiency, and by lowering costs without sacrifice of operating advantages. Write for complete information. Riley Stoker Corp.

2—See page 148. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

3—See page 153. Amesteam Generator: Dependable, quick steaming unit. Minimum installation expense, economical operation. Write for free Bulletin for full description and operational data. Ames Iron Works.

4—See page 48. Steam-Pak Generator: Efficiency originates with the Iris Shutter that controls the air injected into the burner for proper flame control with either gas or oil. Ask for Bulletin 37-43. York-Shipley, Inc.

5—See page 39. Packaged Steam Generators: Send for fully illustrated Catalog 202 that gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

6—See page 62. Fan Stacks: Prat-Daniel offers an integrated induced draft system, combining the three elements of stack, breeching and I. D. fan, into one complete induced draft unit for highest efficiency. Write for the Prat-Daniel catalog on Fan Stacks. No obligation. Prat-Daniel Corp.

7—See page 164. Oil or Gas Fired: Self-contained unit, shipped complete with all equipment necessary for low cost installation. Write for free catalog. The C. H. Dutton Company.

8—See page 28. Boilers By Bigelow: Type F and FH boilers are available in capacities from 20,000 to 100,000 pounds of steam per hour. Design pressures range from 160 to 450 lbs psi. These boilers are designed for oil, coal or gas firing. For further information, write for Bigelow's catalog or contact your nearest Bigelow representative. The Bigelow Company.

9—See page 113. Unit Steam Generators: Practical engineering information about these units is yours for the asking in the new edition of this firm's bulletin. Preferred Utilities Mfg. Corp.

BOILER FEED WATER

10—See page 6. Modern pH and Chlorine Control Book: New 96-page data-reference book describes scientific outfits and improved methods to step up boiler efficiency and prevent scale, corrosion, and embrittlement. W. A. Taylor and Co.

11—See page 9. Water Conditioning: Write for sound recommendations of Betz' engineers to help you select the water conditioning service best suited for your boiler plant. W. H. & L. D. Betz.

12—See page 2. Water Softeners: "Double-Check" line of softeners feature newly designed manifold and high-capacity zeolite. The "Double-Check" Method can also be applied to your present softener for dollar saving advantages and extra capacity. Write for new Bulletin 610. Elgin Softener Corp.

13—See page 45. Water Conditioning System: Write for full facts concerning this system that gives you, in less space, all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Send for Bulletin W-212-B4. Worthington Pump and Machinery Corp.

14—See page 155. Scale and Corrosion Control: Write for your copy of "The Sand-Banum Story". This pocket-size booklet thoroughly explains colloidal control of scale and corrosion; gives you a simple, understandable description of application and how it works. Be sure to send for this booklet today. American Sand-Banum Co., Inc.

15—See page 57. Cuno Flo-Klean Filter: Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in as short a time as a year. See page 57 for coupon which offers complete information without obligation on Cuno Flo-Klean for your particular application. Cuno Engineering Corporation.

16—See page 166. Water Softeners: A new Graver Bulletin explaining the functions, principles and applications of Hot Process Softeners and the distinctive features of Graver designs is now available. Write for your copy today. Graver Water Conditioning Co.

CLEANERS AND BLOWERS

17—See page 157. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 Models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

18—See page 155. Portable Electric Blower: Protect motors and other equipment from burnouts and bearing failure by removing dangerous dust, dirt and lint. Write for Bulletin 579 for complete information on the TORNADO. Breuer Electric Mfg. Co.

19—See page 133. Axial Flow Blower: Standardaire Positive Displacement Blowers are built in a series of sizes to fulfill a wide range of capacity requirements from directly connected, standard speed motors to give you just the amount of air required at the minimum cost. For full information and a complete list of blower sizes, write for Standardaire Selection Chart, Publication No. 86. The Standard Stoker Co., Inc.

20—See page 58. Dry Gas Scrubbers: Based on a dry process of separating foreign material from gas, the Aerotec method eliminates the need for a cleaning medium, insures a minimum carryover of foreign matter into the gas stream. Units are available in practically any size up to 100,000,000 scfd. Larger capacities may be handled by manifolding these standard units to any desired capacity. Complete information on this new method is now available. Write for Catalog 501-2W today. The Thermix Corporation, The Aerotec Corporation.

TO GET YOUR FREE COPIES OF THIS NEW LITERATURE CIRCLE THE CORRESPONDING NUMBERS ON ONE OF THE CONVENIENT POST CARDS ON PAGE 37. MAIL A CARD TODAY. NO POSTAGE NECESSARY.

COMPRESSORS

21—See page 141. Motor Driven Compressors: Write for Bulletin 4910 which contains full details and operating data on Schramm's complete line of motor driven compressors. You're sure to find the right combination for your job. Schramm, Inc.

DIESEL POWER

22—See page 50. Superior Diesels: Be sure to read the remarkable success story on page 50 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated booklet "Superior Diesel For Stationary Application". The National Supply Company.

23—See page 4. Nordberg Diesels: Built in sizes from 10 h.p. to 3500 h.p., in a wide range of gas and oil burning types. Dependable power at low operating cost. Write for further details, outlining your requirements. Nordberg Mfg. Co.

24—See page 33. Smaller, Lighter, Heavy-Duty Diesel Engine: Ingersoll-Rand TS Diesel available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. Extra stamina and dependability of big-engine design. Write today for more information on the new RS Diesel—or for greater power, ask about the well-known S and SS Diesels up to 900 hp. Ingersoll-Rand.

DUST & FLY ASH COLLECTING EQUIPMENT

25—See page 65. Dust and Fume Control Systems: Send for free booklet, "Dust Collecting Systems in Metal Industries". Shows typical installations and exact data that will help you control these problems better in your own plant. Kirk and Blum Mfg. Co.

26—See page 127. Dust Control: Write for information on how dust control equipment can create better working conditions that result in more production and lower costs. Dracco Corporation.

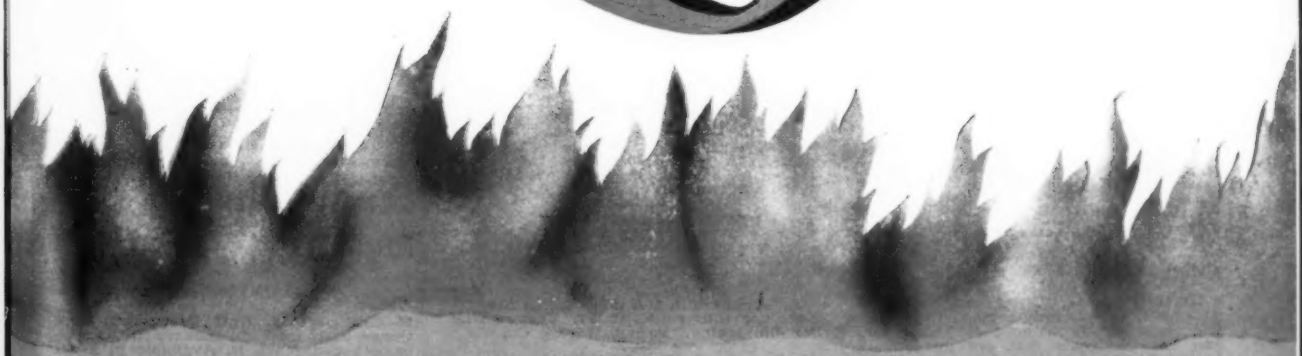
ELECTRICAL EQUIPMENT

27—See page 47. Mica-Glas Insulated Coils: Write for more information about the services of the National Field Engineer. National's experience can pay off in lower maintenance cost for rotating electrical machinery in your plant. National Electric Coil Company.

28—See page 164. Automatic Voltage Regulator: Send for copy of Bulletin 547. Contains information on Type IE, all-electronic regulator that acts instantaneously to keep delivered voltage to within

(Continued on page 26)

WHY fireye



There's only one reason for putting a Flame Failure Safeguard on an oil or gas burner . . . to prevent an explosion . . . to safeguard your entire plant, equipment, and personnel.

Fireye insures complete flame failure protection because it is photoelectric . . . it sees the flame . . . and if the flame fails, Fireye acts wth the speed of light to cut off the fuel *before* dangerous gases accumulate in the combustion chamber.

Controls which do not react instantaneously can *not* provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction.

Fireye is the outstanding combustion safeguard which meets the exacting requirements of insurance laboratories for the protection of ALL classifications of oil and gas burner installations.

FACTORY MUTUAL FM APPROVED

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Write for bulletin 604-C

fireye

COMBUSTION CONTROL CORP.

Flame Failure Safeguards for Oil and Gas Burners

77 BROADWAY, CAMBRIDGE 42, MASS.

READERS' GUIDE ... CONTINUED ...

(Continued from page 24)

+ 0.1 volts of pre-set value. The Superior Electric Co.

29—See page 138. Big Value in a Small Switch: For controlling small motors (up to 2 hp) for handling heavy lighting loads (up to 30A)—the 6808 is an old favorite with design and maintenance men. Small size and low cost make it ideal for wide range of application in which overload protection is not necessary. Write for literature on this switch and the No. 7810 for use with AC only. The Arrow-Hart & Hegeman Electric Company.

FLOOR REPAIRS

30—See page 161. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or complete overlay. Used indoors or out. Dries fast. Send for free trial offer and complete information. No obligation. Flexrock Company.

31—See page 156. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and complete information. Flexrock Company.

FUELS AND FIRING EQUIPMENT

32—See page 149. New Automatic Oil Burner: Wide-range oil-burning system assembled complete on one base for all types of boilers and furnaces from 100 developed hp and up. Write for your copy of new Bulletin 400 for full details and specifications. Peabody Engineering Corp.

33—See pages 12, 13. Perfect Spread Stoker: Compact, fully-protected mechanism runs quietly without clogging. You can use the coals that are attractively priced in your locality. See pages 12, 13 for handy coupon which will bring you full information about Perfect Spread Stokers and Taylor Underfeed Stokers. American Engineering Company.

HEATING, VENTILATING AND AIR CONDITIONING

34—See page 27. Coppus Blowers: For man-cooling and removing fumes from confined places, as well as for cooling and drying materials and equipment. Check and mail coupon on page 27 for specific information. Coppus Engineering Corp.

35—See page 23. Thermolier Unit Heaters: Combine these important advantages: low first cost, economy of operation, heating comfort, adaptability to equipment and floor layout designed for durability and dependability. Write for Thermolier Catalog containing full details on features, capacities and types. Grinnel Company, Inc.

36—See page 146. Combustion Equipment: Take advantage of the experience and "know-how" of Todd engineers for increased economy and efficiency in the burning of liquid and gaseous fuels. Write for details about your particular problems today. Todd Shipyards Corp.

37—See page 21. Tankless Water Heaters: Provide independent hot water supply for washrooms or process units. No tank to install. Use as booster to your present tank-type system. Available in 19 sizes up to 300 gpm. Write for Catalog 19. General Fittings Co.

38—See page 140. Heating Specialists: Petro-Chem Development Company engineers. They can supply the whys and wherefores of indirect versus direct heating and the economics of both. Every day more than 600 oil and gas fired Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation. Write for additional details. Petro-Chem Development Co., Inc.

HEAT EXCHANGERS

39—See page 34. Flim Type Exchangers: Interesting Bulletin HE-5 is a pictorial presentation of standard and special types of heat exchangers. Write for your copy. Henry Vogt Machine Co., Inc.

INSTRUMENTS

40—See page 147. Flow Indicators: Accurately register the rate of flow from zero 100%, and can be installed right in the pipe line. Send for Bulletin FI-1. Henszey Co.

41—See page 136. Severe Service Thermometers: Ask for Bulletin "E" for full information on the "Princo" thermometer built for those really tough service connections. Ask for prices and description of the new dial thermometer, too. Precision Thermometer & Instrument Company.

42—See page 159. Ernstlit Adjustable Inclined Column: Send for Bulletin T-1 which contains specifications of the Ernstlit adjustable inclined column, specially designed for package type boilers up to 300 Pounds W.S.P. Full information, too, on Leakless Try Cocks. Write today. Ernst Water Column & Gage Co.

43—See page 156. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

44—See page 143. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications—wide variety of types. Write for Thermometer Bulletin. Weston Electrical Instrument Corp.

45—See pages 66, 67. Liquid Level Indicators: Following bulletins give complete data on Yarway indicators: Bulletin WG-1830 for Hi-Lo Graph; Catalog WG-1811 for Water Cclumns and Gages; Catalog WG-1822 for Remote Liquid Level Indicator and Remote Horn and Light Signal Alarms. Send for your copies today. They're free for the asking. Yarnall-Waring Co.

46—See page 158. Dial Thermometers: Vapor pressure actuated. 4" dials with rigid stem or flexible tubing type. Get full details in new free Bulletin No. 355. The Powers Regulator Co.

INSULATION

47—See page 43. Kaylo Insulating Material: Available in block or pipe covering form, this material is remarkably efficient throughout a wide 200°—1200° F. temperature range. Send for your free samples and descriptive literature. Kaylo Division, Owens-Illinois Glass Co.

48—See page 160. Block Insulation: Single layer construction gives insulating efficiency equal to double-layer insulation at all temperatures up to 1600°. Easily handled and cut. Unaffected by water and steam. Ask for Bulletin I-76. Get complete information today. Refractory & Insulation Corp.

116—See page 147. Pipe Insulation: Write for your free sample of jacketing which gives you these advantages: lowest application costs; requires no painting; maisture proof; will not rust away; improves appearance; eliminates costly repairs and maintenance. Childers Manufacturing Co.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

49—See page 32. Lubriplate Lubricants: Ask for facts and figures on the variety of oils and greases developed to give protective lubrication to your machinery even under conditions of moisture and acids. Fiske Brothers Refining Co.

50—See page 111. Indicating Oils: Designed for the toughest lubrication jobs Sunvis "900" oils are in use today in turbines, circulating systems, hydraulic systems, textile machinery and many other applications. Ask for booklet. Sun Oil Company.

51—See page 117—Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

52.—See pages 54, 55. Sinclair Rubilene Oils: Rubilen e resists axidation; retards the formation of damaging acidic compounds, gum and sludge; is non-foaming. Additional information on request. Sinclair Refining Co.

53.—See page 145. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

54—See pages 35, 36. Stanolith Grease: The right grease for the right job not only cuts grease costs but saves down-time, man hours and headaches. A Standard Oil Lubrication Engineer will be glad to help you with your individual problems. Write today. Standard Oil Company (Indiana).

MAINTENANCE

55—See page 17. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corp.

56—See page 154. Free Repair Handbook: 40-page guide containing diagrams and instructions for making lasting and economical repairs to concrete floors, plant equipment and machinery. Smooth-On Mfg. Co.

114—See page 160. Complete Service for Elevated Water Tanks: 30 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication, "Sound Principles of Water Tank Maintenance and Tank Talk". Dixie Tank and Bridge Co.

MATERIAL HANDLING

57—See page 145. Pneumatic Ash Handling System: Economical, labor-saving "Vac-Veyor" conveys and delivers the ashes to the silo, in a completely dry condition. Write for more information. Beaumont Birch Co.

58—See page 121. Diesel Electric Locomotives: Porter engineers will be glad to survey your switching requirements and submit specifications for a standard or, if necessary, a special unit designed to your individual requirements. A Porter engineer can show you how to cut your switching costs. H. K. Porter Company, Inc.

59—See page 161. Drop Side Snatch Blocks: Self-lubricated bearing, snarl-proof construction, drop side for easy stringing and unstringing, forged steel hook and sheave for maximum strength. Write for price and additional information. Well Equipment Mfg. Corp.

60—See page 69. Airslide Conveyor: In this system, dry pulverized materials are aerated or fluidized and made to flow like water. Completely enclosed to eliminate danger of contamination. Dusting is eliminated. Only power required is low pressure air. Saves time and space. Write for complete details. Fuller Company.

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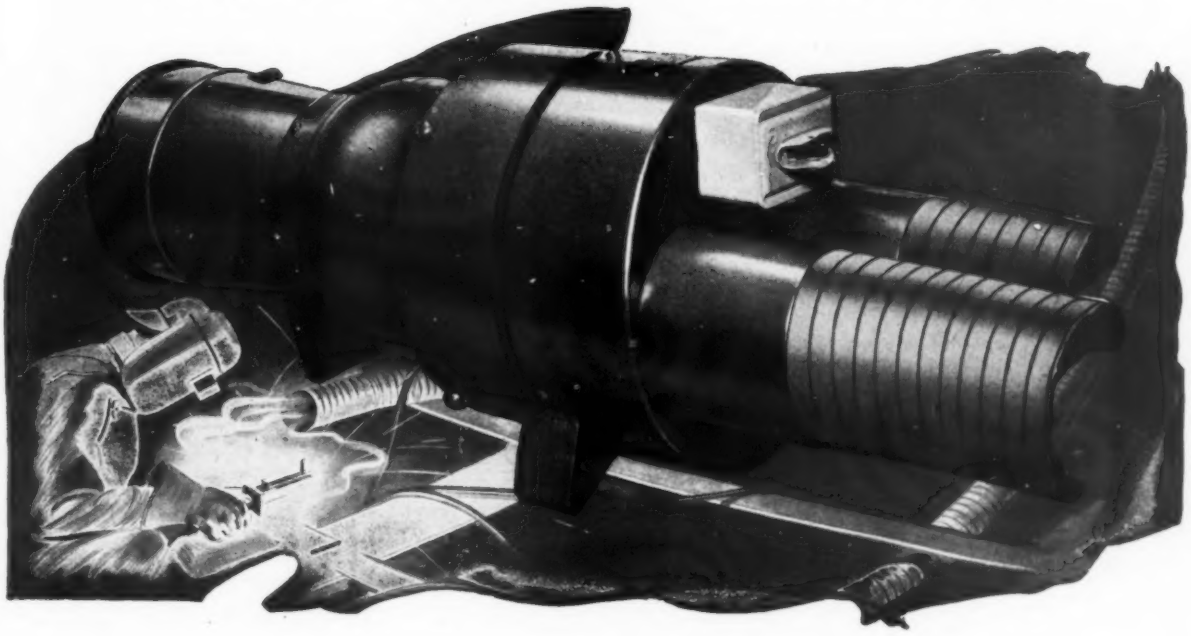
(Continued on page 28)

An Extra Lung for A Man

HAVING TROUBLE BREATHING



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The baffles are arranged to assure maximum heat pick up which means lower stack temperatures. The rear passes are baffled so that the cross section area is restricted, compensating for the decreased volume of the partially cooled gases.

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BI-1

BOILERS BY BIGELOW

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—Bent Tube Types
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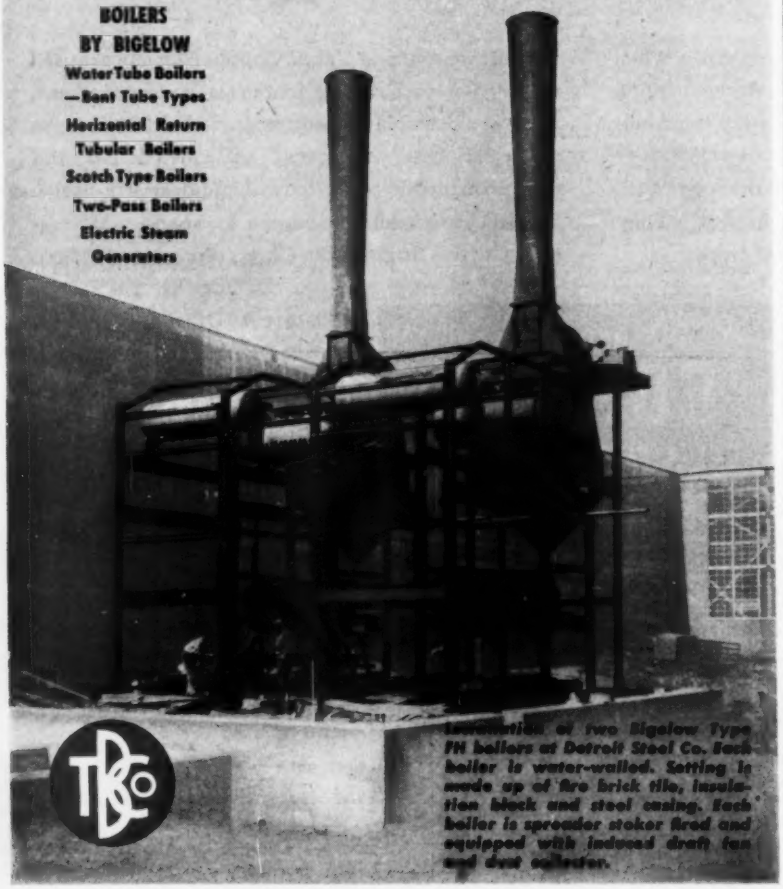
Two-Pass Boilers
Electric Steam Generators



Installation of two Bigelow Type FH boilers at Detroit Steel Co. Each boiler is water-walled. Setting is made up of fire brick tile, insulation block and steel casing. Each boiler is spreader stoker fired and equipped with induced draft fan and dust collector.

READERS' GUIDE

(Continued from page 26)

PACKINGS AND GASKETS

61—See page 68. Valve Stem Packing: R/M Braided Valve Stem Packing is made of long fibre asbestos yarns in braid over braid construction lubricated to insure softness and pliability. Widely used on valve stems and reciprocating rods and plungers. Write for data on R/M No. 303. Raybestos-Manhattan, Inc., Packing Division.

62—See page 51. Navalon Packings: Made of ramie, a natural fiber that gets stronger when wet, these packings are for service against fresh or salt water, brine, cold oil and for use on pumps, elevators, accumulators, presses and reciprocating rods. Ask for Folder PK-32A. Johns-Manville.

PIPE AND FITTINGS

63—See page 125. Pipe Unions: Bronze-to-bronze ball joints insure long life and tight joints. Because of precision in manufacture these unions can be disconnected and reinstalled many times. Send for complete information today. E. M. Dart Mfg. Co.

64—See page 31. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. Ask for Publication C-24. The American Brass Company.

65—See page 61. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass ompany.

66—See page 46. Simplified Expansion Control: CMH has reduced the expansion joint selection problem to a matter of charts from which the joints necessary to meet your requirements may be selected quickly and easily. For unusual installations CMH offers its "Engineered Application Service". Write for complete details and recommendations for your particular problems. Chicago Metal Hose Corporation.

PLANT EQUIPMENT

67—See pages 18, 19. Chains: This company specializes in the manufacture of sprocket chains, sprockets and attachments. An inquiry will show you how this specialization means better service to you. The Union Chain and Mfg. Co.

68—See page 131. The Right Hose For Every Need: Whatever your hose needs, it will pay you to put the problem up to Hewitt-Robins headquarters. Special research and constant factory testing assures the right material combination of each type of hope for every service requirements. Write for complete details. Hewitt-Robins Incorporated, Hewitt Rubber Division.

69—See page 162. New Steel Platform Trucks: All-steel body eliminates excess weight, permits heavier loads per truck. Long-life—practically no maintenance cost. New, functional design increases strength, makes handling easier. Write for your copy of Bulletin 718. Standard Pressed Steel Co.

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"Packaged" Systems

for BOILER WATER CHEMICAL TREATMENTS

The necessity is well recognized for feeding various chemicals to boilers for the prevention of scale and to control alkalinity, remove dissolved oxygen, protect against embrittlement and insure against corrosion and pitting caused by impurities in the boiler feed water. Practically all competent authorities agree that two distinct methods for conditioning boiler water are necessary.

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Typical Milton Roy "Packaged" Systems for boiler water treatment are illustrated above. These systems are complete, include all necessary solution tanks, covers, gage glasses, low-level cutouts and alarms, motor starters and pumps as required. Automatic electronic controls can be supplied to operate pumps at speeds proportional to feed water flow as measured by flow meters. Systems are available to handle all treating chemicals and to meet all capacity and pressure requirements.

For complete information, ask for Bulletin 4811 and Technical Paper No. 51 "What the Power Engineer Needs to Know about Chemical Feed Systems."

MILTON Roy COMPANY

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READERS' GUIDE . . . CONTINUED . . .

(Continued from page 28)

POWER TRANSMISSION

70—See page 119. Roller Chain Drives: Diamond Chain offers the machinery designer the same advantages for intra-machine applications as it does for the primary drives. Wherever shafts are to be driven, regardless of speed or direction of rotation, Diamond Roller Chains can do the job efficiently. Write for full details. Diamond Chain Company, Inc.

71—See page 144. Motor Couplings: Ask for Catalog 57 which gives full details, ratings, and service factors for gear-type, all-steel couplings. John Waldron Corp.

72—See page 15. Roller Bearings: Every Hyatt Hy-Load Roller Bearing is built to last. Straight radial construction offers greater load carrying capacity and longer bearing life. The service of Hyatt engineers is available to builders of equipment in helping them select the bearings best fitted for the job. Hyatt Bearings Div., General Motors Corp.

73—See page 116. Fan-Cooled, Worm Gear Speed Reducers: Write for Catalog 200 for standard drives, and Catalog 300 on Speedaires that do more work, deliver double the horsepower of standard worm units of same frame size. Save money, space, and weight. The Cleveland Worm & Gear Co.

74—See page 40. SKF Spherical Roller Bearings: Specified for the imposing list of tunnel installations shown on page 40 because they're self-aligning, long-lived, require infrequent lubrication and inspection, give continuous trouble-free service under highly adverse conditions. Additional details will be sent on request. SKF Industries, Inc.

75—See page 3. V-Belt Drives: Ask the Goodyear Technical Man or write direct for information about HY-T Multi-V-Belts for normal speed, heavy shock-load drives, as well as the other Goodyear V-Belt constructions to meet specific drive demands. The Goodyear Tire & Rubber Co.

PUMPS

76—See page 115. Weinman Pumps: Designed and manufactured by Centrifugal Specialists who are concerned with but one product... pumps that work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. An inquiry will get prompt attention. The Weinman Pump Mfg. Co.

77—See page 137. Controllable Capacity Pumps: Endurance, low-up-keep plus a saving in power. Send today for material giving full details and ratings of Aldrich-Groff "Power-Savr" Controllable Capacity Pumps. The Aldrich Pump Co.

78—See page 163. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

79—See page 64. New Cradle Mounted Compacunit Pump: Sizes: 1", 1½", 2", 3". Capacities: 5 to 450 gpm. Heads: 15 to 500 ft. Materials: standard, all iron, all bronze, or special to meet your requirements. Check this pump against your next pumping job for most versatile, efficient operation. Write for Bulletin No. 242 for complete information. Warren Steam Pump Company, Inc.

115—See page 29. Chemical Feed Systems: Write for Bulletin 4811 and Technical Paper No. 51 "What the Power Engineer Needs to Know about Chemical Feed Systems". Milton Roy Company.

REFRACTORIES

80—See page 159. Boiler Seam Protector: Bulletin describes a durable, refractory girth seam protector which will stop further leaking and fire-cracking on new seams. National Boiler Protector Co.

REGULATORS AND CONTROLS

81—See page 157. Multiport Valves: Use electrically operated H&T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

82—See page 162. Temperature Regulators: For complete information ask for Bulletins 7A and 6A, or use the coupon on page 162. Atlas Valve Company.

83—See page 25. Combustion Safeguard: Fireye is the safe, modern electronic combustion safeguard for oil, gas, and pulverized coal burners. Provides continuous monitoring of oil or gas flame, programming control for automatic ignition systems, boiler water level control and low level safeguard. Write for Bulletin 604-C for complete details. Combustion Control Corp.

84—See page 53. Automatic Feedwater Regulation and Combustion Control Systems: Complete information and application data is available for the asking on Hagan Combustion Control, Hagan Automatic Feedwater Regulation and Hagan Ring Balance Meters. Write today. Hagan Corporation.

85—See page 160. Room Thermostats: Hermetically sealed mercury switch and lustrous natural metallic finish are only two features of these distinctive room temperature controls. Write for Sensatherm Catalog. The Mercoid Corp.

86—See page 161. Regulators and Thermometers: Write for Bulletins 500 and 1000 for full information on the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer. Their low initial cost will be repaid many times over during their first year of service. H. O. Trerice Co.

87—See page 41. Water Level Control: Send for your copy of Performance Bulletin 485 which gives a complete report on the industrial installation described on page 41. Depend on Copes Flowmatic—the simplest, most widely used flow-level type of feed control. Northern Equipment Co.

88—See page 11. Cooling Controls: See page 11 for the case history of The Harvey Metals Corp. where 2/3 of cooling water was saved with the Sarco TR-21 cooling control. Send for Bulletin No. 700 on Sarco Cooling Controls and see how comparable savings can be made in your plant. Sarco Company, Inc.

89—See page 63. Reducing and Desuperheating Control: Swartwout supplies the combination of equipment best suited for exacting control of the output of modern higher pressure boilers. For a modern, completely automatic reducing and desuperheating station, check your plans with Swartwout. The Swartwout Co.

STEAM TURBINES AND ENGINES

90—See page 60. Power Saving Turbines: Eight-page Bulletin S-116 illustrates and describes application, construction, savings effected and advantages of the Terry solid wheel turbine. Write for your copy now. The Terry Steam Turbine Co.

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TOOLS AND SMALL SPECIALTIES

91—See page 148. Pipe Tools: New catalog, Number S-48, is free for the asking. Contains full information about these improved pipe tools. Send for your copy now. Armstrong Bros. Tool Co.

92—See page 135. Tube Cleaners: New ROTOJET cleaners, air or water-driven models, for practically any size straight or curved tubes. Use less power. Write for more details and prices. Elliott Company —Roto Division.

93—See page 151. Tube Cleaners and Expanders: Write for data on Airetool's cleaners that remove the most severe scale deposits quickly and safely from all sizes of bent and straight tubes. Write for further information on tube cleaners, tube expanders and accessory tools. The Airetool Manufacturing Co.

TRAPS, STRAINERS AND SEPARATORS

94—See page 167. Impulse Steam Trap: Discharge continuously under heavy loads, quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

95—See page 129. Trap With No Moving Parts: Provides continuous and complete air and condensate elimination, and visual operation indicator; requires no by pass; fits into line like a valve. Write for Drainator Catalog. The Coe Mfg. Co.

96—See page 59. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

97—See page 116. Steam Traps: Catalog No. 448 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

98—See page 142. Obsolete Traps: It costs less than you think to repair obsolete or faulty traps. Often the existing trap body can be re-used. A Webster Thermostatic Assembly can be screwed into the original cap—Webster Bulletin B-850 tells how. Write for a copy. Warren Webster & Company.

VALVES

99—See page 152. Dual-Valve Blow-Off. A "regular" EVERLASTING valve that opens fully with one short movement of the lever... a wheel-operated EVERLASTING companion valve built to take the full punishment of the blow-off. For full information write for Bulletin. Everlasting Valve Co.

100—See page 144. Slide and Butterfly Valves: Rockwell designs many valves for special applications. Your inquiries are invited. Also send for catalog describing complete line of standard valves to 84" pipe size—manual or automatic controls. W. S. Rockwell Company.

101—See page 159. Valves: Bulletin "A-P" shows how Valvair's three body styles (2-way, 3-way, 4-way, and piped exhaust) plus many methods of actuating, provides over 103,000 variations to suit just about any possible set of requirements you may have. Send for your copy right away. Valvair Corp.

102—See page 44. Non-Metallic Disc Valves: Circular No. 558 tells how this unique design provides for easy replacement of discs in globe, angle, check and quick operating type valves. No regrinding is necessary. The Lunkenheimer Co.

103—See page 56. Check Valves: Chapman Tilting Disc Check Valves work with the stream so pipe line stresses are practically eliminated. Head losses are reduced

(Continued on page 32)

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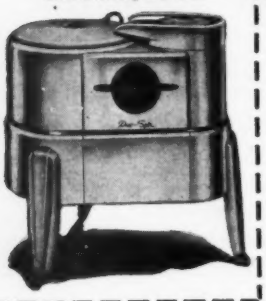

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READERS' GUIDE

(Continued from page 30)

65% to 80%. Write today for engineering data and reports of tests. The Chapman Valve Mfg. Co.

104—See page 38B. Slotted Wedge Cast Steel Gate Valves: Get your copy of this company's 300-page Catalog No. 17M which describes all types of Darling valves and is full of information of general value. Darling Valve and Manufacturing Co.

105—See page 123. All Iron Gate Valves: Made of high-test alloy iron to withstand the action of many of the strongest chemicals. Low in maintenance cost, easy to operate, long lasting in service. For full details write today. The Fairbanks Company.

WELDING EQUIPMENT

106—See page 52. New Hard-Facing Rods: Three new rods designed to meet the most severe conditions of wear-abrasion, impact, and corrosion. They are all easy to apply. Use them to hard-face the wearing parts of your machines and equipment. Order from your local jobber or write for his name and address or more complete information. The Linde Air Products Co.

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107—See page 38A. Preformed Wire Rope: With no pent-up stresses held within the rope structure this rope operates over sheaves and drums with less fatigue. Complete data on request. Wickwire Spencer Steel Div. of Colorado Fuel & Iron Corp.

MISCELLANEOUS

108—See page 139. Important Booklet: Send for free copy of 40-page brochure of up-to-date facts and figures—a valuable study for anyone considering a cost-saving manufacturing and distributing location on the Atlantic seaboard. "Industrially Yours—New Jersey" belongs on your desk. New Jersey Council.

109—See page 146. Electrical Engineering and Construction: Complete technical service—staff of 10 electrical engineers and designers available for consultation. Capacity to handle complete installations on all industrial and commercial light and power problems. Write today. No obligation. Hyre Electric Co.

110—See page 158. Combustion Engineering Course: Send for book "Opportunities for the Combustion Expert," which offers a complete outline of the Hays Home Study Course. Hays School of Combustion.

111—See page 154. Check This Economy Move: Over 1900 firms supply the more than 33,000 products which Hajoca stocks for industry. Use this one source and eliminate your high cost of dealing with many sources of supply for the industrial products you use. Hajoca Corporation.

112—See page 158. Powdered Rosin: A better product because it is produced with proper equipment, carefully supervised during milling processes, laboratory tested to assure proper color and quality. Get acquainted with Penick's Powdererd Rosin by asking for easy pound sample. S. B. Penick & Company.

113—See page 165. New Remington Superiter: Better, faster performance at measurably less cost because: tempo-touch action and super-plus values such as finger-fitted keys, longer writing line, one-key keyboard margin control, and exclusive perfect positioning scale. Send for your free bulletin, "An Efficient Typing Station". Remington Rand.

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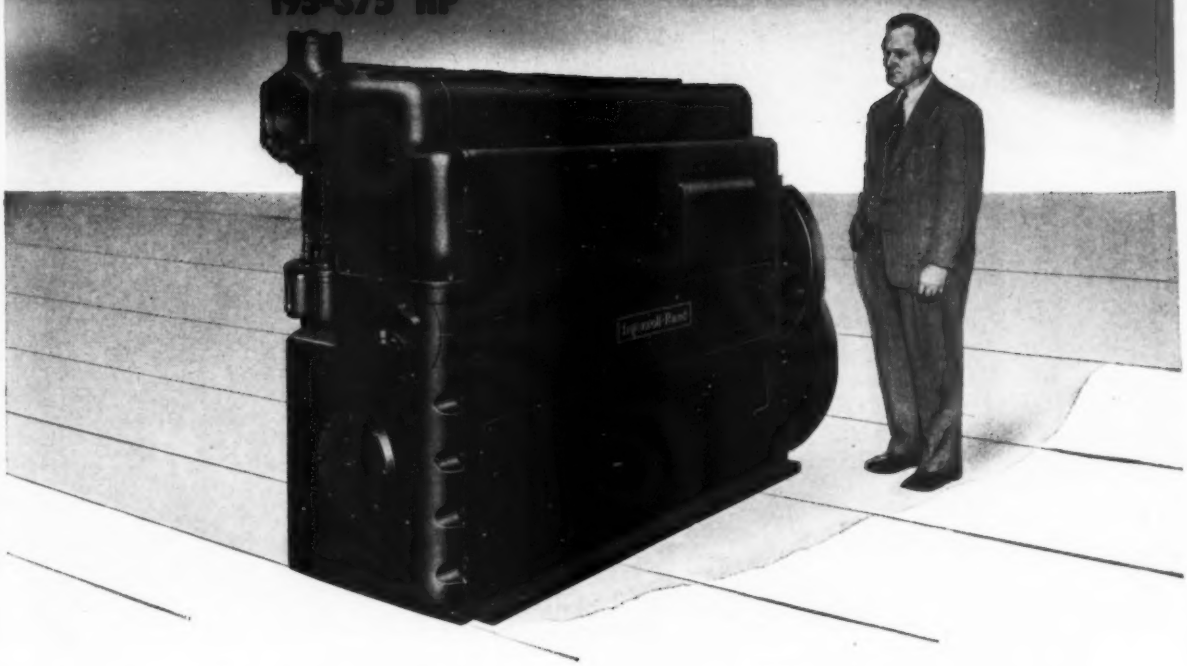
The Ingersoll-Rand TS

195-375 HP



Here's the heavy-duty Diesel that engineers have been looking for... a 4-cycle, single-acting engine that weighs only 30 lbs per hp, and consumes only 0.40 lbs of fuel per hp-hour.

The Ingersoll-Rand TS Diesel is available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. What's more, the new TS Diesel has the extra stamina and dependability of big-engine design. Its 5¼"-diameter crankshaft is extra-large for a 7"-bore engine.

Movable	but NOT Automotive Type
Low Weight	but Moderate Speed
Small Size	but BIG-Engine Design
Powerful	but LOW Exhaust Temperatures
Perfect Balance	but NO Balancing Devices

These results have been achieved by using an improved combustion system with single-hole injection nozzles, a gear-driven supercharger providing additional scavenging air for internal cooling, an increased overlap of exhaust- and intake-valve openings, and a big crankshaft. One of the distinctive low-maintenance and long-life features is its aluminum-alloy full-floating bearings... with each half bearing being interchangeable for main and crankpin bearings.

Engineers who have seen the TS Diesel agree that it is the outstanding advance in diesel design in the past decade. Write today for more information on the new TS Diesel... or for greater power ask about the well-known S and SS Diesels up to 900 hp.

The New Ingersoll-Rand TS Diesel is ideal for:

Drilling Rigs	Locomotives	Emergency
Shovels	Drag Lines	Generating
Crushers	Cranes	& Pumping
Scrapers		Units

And for any service requiring continuous full-load economical operation.

Ingersoll-Rand
11 Broadway, New York 4, N. Y. 500-7

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL & GAS ENGINES

Presenting

a pictorial record of standard and special built HEAT TRANSFER EQUIPMENT

by **Vogt**

You are invited to send for this record of ingenuity in heat exchanger design and construction.

Shown, among examples of the many types we build, are units for diversified applications, high pressures, and special operating conditions as well as conventional types for ordinary exchanger services in petroleum refineries, chemical plants, process industries, power plants, etc.

Thousands of installations in successful operation attest to Vogt's ability to give effective help in the solution of heat transfer problems peculiar to a wide variety of operating conditions.

Write for a copy of Bulletin HE-5, on your letterhead.

HENRY VOGT MACHINE CO.
INCORPORATED
LOUISVILLE 10, KENTUCKY
BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

Schooled to serve you...

YOU benefit when these men go to school!

These men are Standard Oil lubrication specialists, skilled and experienced in the use of modern lubricants. They are representative of the groups who come year after year from Standard Oil Company (Indiana) sales fields throughout the Midwest to learn about new machinery and the most up-to-date methods of lubricating them. In lecture rooms and in well-equipped laboratories, they are taught new ways to raise economy and efficiency of your operations.

The benefits held out to you by these lubrication specialists are multiplied by a service-distribution set-up that is unique in the oil industry. To serve your midwest operations, Standard Oil has located practically right in your own backyard a completely stocked warehouse and the office headquarters for a lubrication specialist. The nearness of this service-supply center *means faster deliveries to you* of necessary fuels and lubricants. It assures you of getting the product you need when you need it. It puts the services of the lubrication specialist at your immediate disposal.

These advantages are well worth investigating. Arrange, now, for the visit of a lubrication specialist. If your plant is located in any of the states below, simply phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

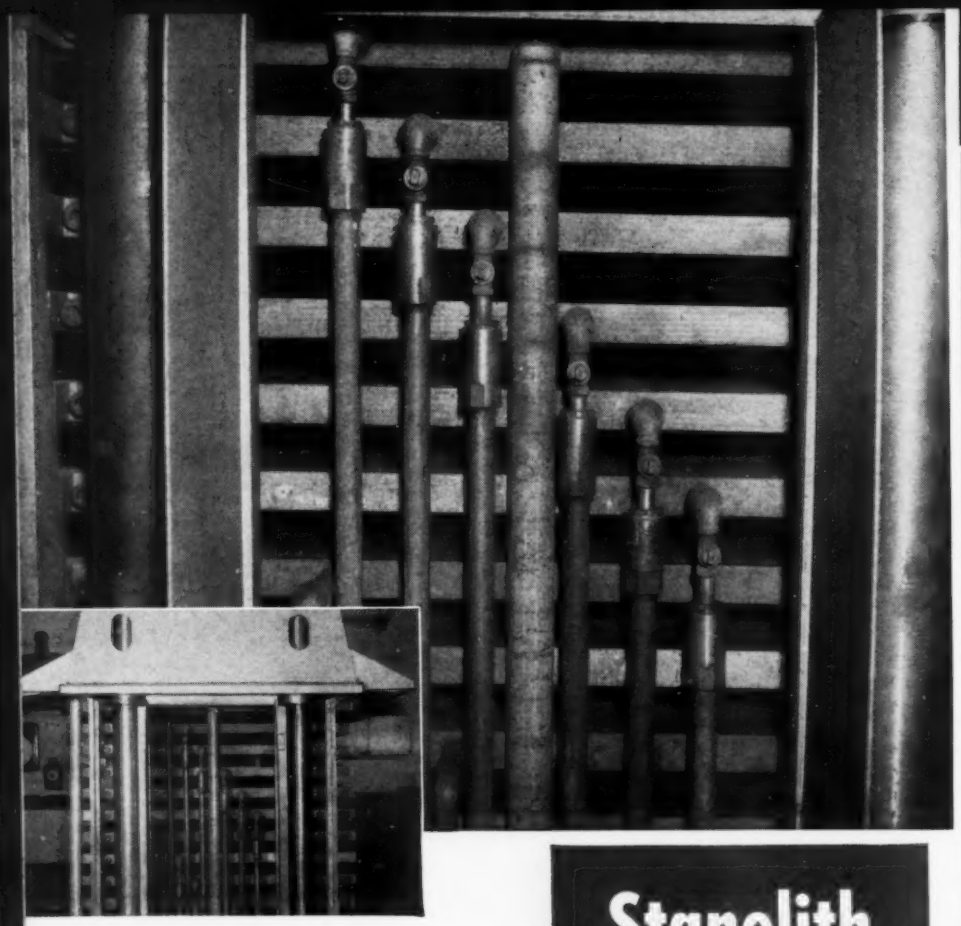
1 SERVICE-SUPPLY POINTS are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 LUBRICATION SPECIALISTS have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 RESEARCH AND TECHNICAL FACILITIES are geared to help solve your specific lubrication problems.

Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Montana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin, Wyoming

STANDARD OIL COMPANY (INDIANA) STANDARD



Stanolith Grease

Stops trouble on steam joints . . .

• Lubrication of the telescopic steam joints on a hot-plate veneer press was a continual problem for a midwest manufacturer. The job required a grease that would withstand temperatures of 240° to 260° F. and the severe washing action of steam and water.

Conventional greases failed to meet these requirements. Joints had to be lubricated frequently. This interfered with production and resulted in excessive consumption of the lubricant.

A Standard Oil lubrication specialist suggested that STANOLITH Grease No. 57 be used. This is a lithium soap product capable of standing up under high temperatures and of resisting the washing action of water. Since the switch to STANOLITH the joints have been lubricated between shifts with no interruption of production. *Lubricant consumption has been reduced 40%.*

Where the combination of heat and water causes lubrication difficulties, try STANOLITH Grease. To help you secure maximum benefits from such products, Standard Oil has a specially trained and experienced lubrication specialist located within easy reach of your plant. How you can take advantage of his services is explained at the right.

Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

D. R. Clay, lubrication specialist at Standard Oil's Grand Rapids office, solved this problem.

He is one of a corps of Standard Oil lubrication specialists located throughout the Midwest to provide "on-the-spot" service to plant operators. One of these lubrication specialists is near your plant. He has plenty of practical experience and has been specially trained for his job in a Standard Oil Lubrication Engineering School. You can obtain his services quickly and easily. Just phone or drop a card to the nearest Standard Oil Company (Indiana) office. Why not arrange, now, to discuss with him the advantages offered by these widely accepted lubricants?

STANOIL Industrial Oils—This multi-purpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

SUPERLA Greases—Available in all consistency grades, SUPERLA Greases cover a wide range of applications. These products are comparable in quality to the highest type of special greases but are as readily available and economical as ordinary cup greases.

CALUMET Viscous Lubricants—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears and chains, better internal lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUST form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a finger print remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD OIL COMPANY (INDIANA

WICKWIRE ROPE

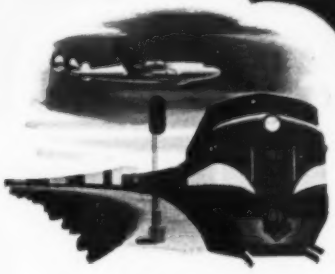
A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

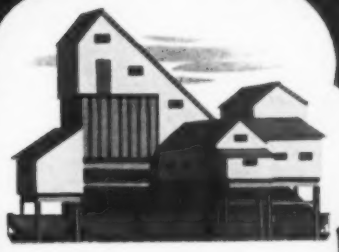
In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® *Pre*formed. It lasts longer — is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant — Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. &I.
500 Fifth Ave., New York 18, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1030—19th Ave., Oakland 6, Cal.

LOGGING



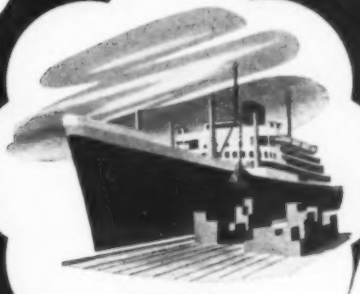
TRANSPORTATION



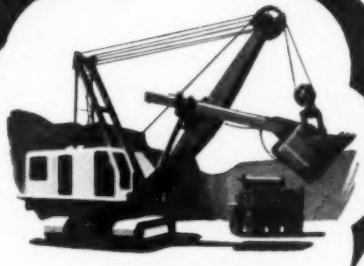
MINING

PETROLEUM

MANUFACTURING



MARINE



CONSTRUCTION

A. L. Bostrom

Common troubles licked here!

HERE is a Darling Gate Valve designed to relieve you of the most common valve troubles. There are a number of contributing features, but let's take only two . . .

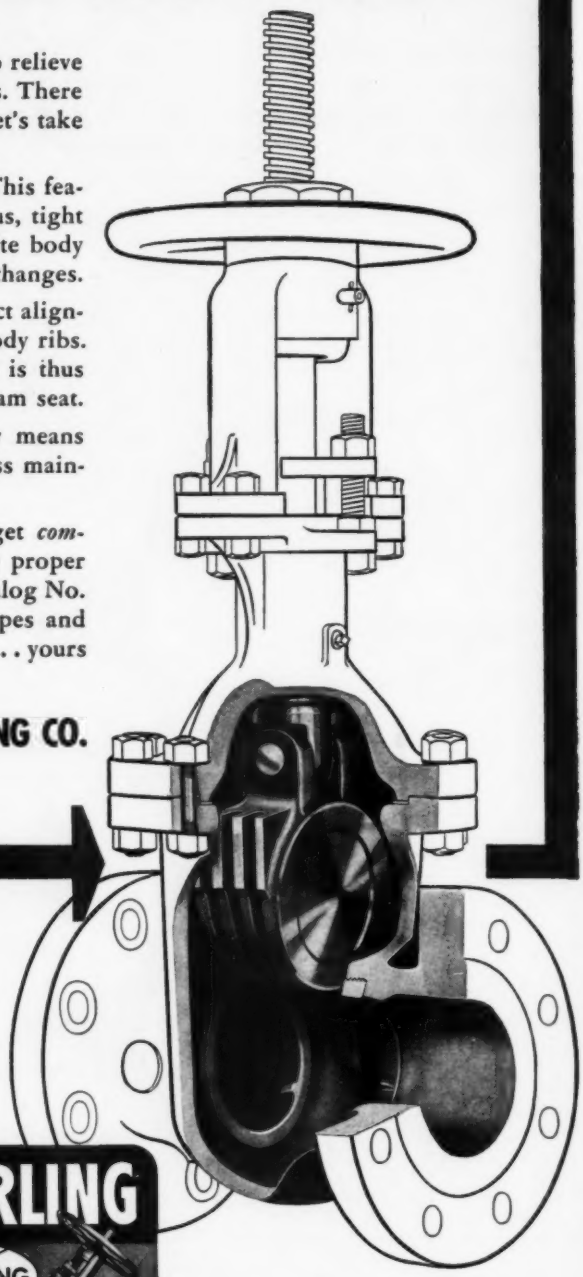
First, note the center slot in the wedge. This feature allows compression of the wedge. Thus, tight closing and easy opening are assured despite body expansion or contraction due to temperature changes.

Secondly, wedge travel is guided for perfect alignment by *double* wedge grooves and *twin* body ribs. Canting of wedge caused by line pressure is thus eliminated, preventing damage to downstream seat.

Here's a combination that just naturally means more reliable operation . . . less trouble, less maintenance, less cost!

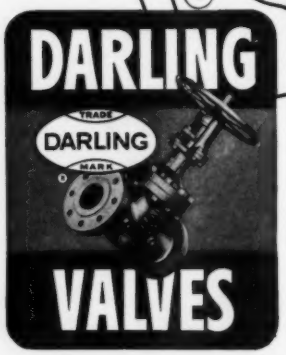
Outline your service requirements and get *complete* information on Darling Valves of the proper type. Or, send for the 300-page Darling Catalog No. 17M. It describes Darling Valves of all types and sizes . . . and is full of data of general value . . . yours for the asking.

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 9, PA.



Darling
Slotted Wedge
Cast steel gate valves

Darling Gate Valves, noted for outstanding quality, strength and precision, are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds. In addition to the *Slotted* wedge types, there are solid wedge taper seat valves and the famous Darling Fully Revolving Double Disc Parallel Seat Gate Valves for virtually any service.



THE VALVE MARK OF QUALITY... WATCH FOR IT

FOR THOSE WHO DEMAND

Something More

. . . than ordinary steam generator performance, SUPERIOR Steam Generators provide the answer . . . and that "something more" is **more** rugged construction; **more** heating surface, **more** steam area, **more** weight per horsepower; **more** accurate control of fuel and air ratios; **more** dependable combustion equipment; **more** years of operation at peak efficiency . . . all of which adds up to 80% or more thermal efficiency which lasts, and lasts. For a steam generator is a long term investment with high dividends when you buy a . . .

Superior

STEAM GENERATOR

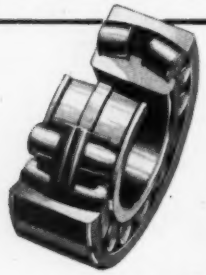
Get the facts. Write today for your copy of our new catalog 202.

uperior ombustion ndustries, inc.

Executive Offices: Times Tower, Times Square, New York 18, N. Y.

TYPICAL SKF VEHICULAR TUNNEL INSTALLATIONS

Location	Number of Fans	Fan Manufacturer
LINCOLN TUNNEL, New York—South Tube	36	Buffalo Forge Company
LINCOLN TUNNEL, New York—North Tube	20	Westinghouse Electric Corp.—Sturtevant Division
QUEENS MIDTOWN TUNNEL, New York	46	Westinghouse Electric Corp.—Sturtevant Division
GEORGE WASHINGTON BRIDGE APPROACH TUNNEL, New York	8	Buffalo Forge Company
PENNSYLVANIA TURNPIKE—7 TUNNELS	26	Westinghouse Electric Corp.—Sturtevant Division
BANKHEAD TUNNEL, Mobile, Ala.	3	Clarage Fan Company
BROOKLYN BATTERY TUNNEL, New York	53	Westinghouse Electric Corp.—Sturtevant Division
BROOKLYN BATTERY APPROACH TUNNEL, New York	12	Westinghouse Electric Corp.—Sturtevant Division
WASHBURN TUNNEL, Houston, Texas	5	Westinghouse Electric Corp.—Sturtevant Division

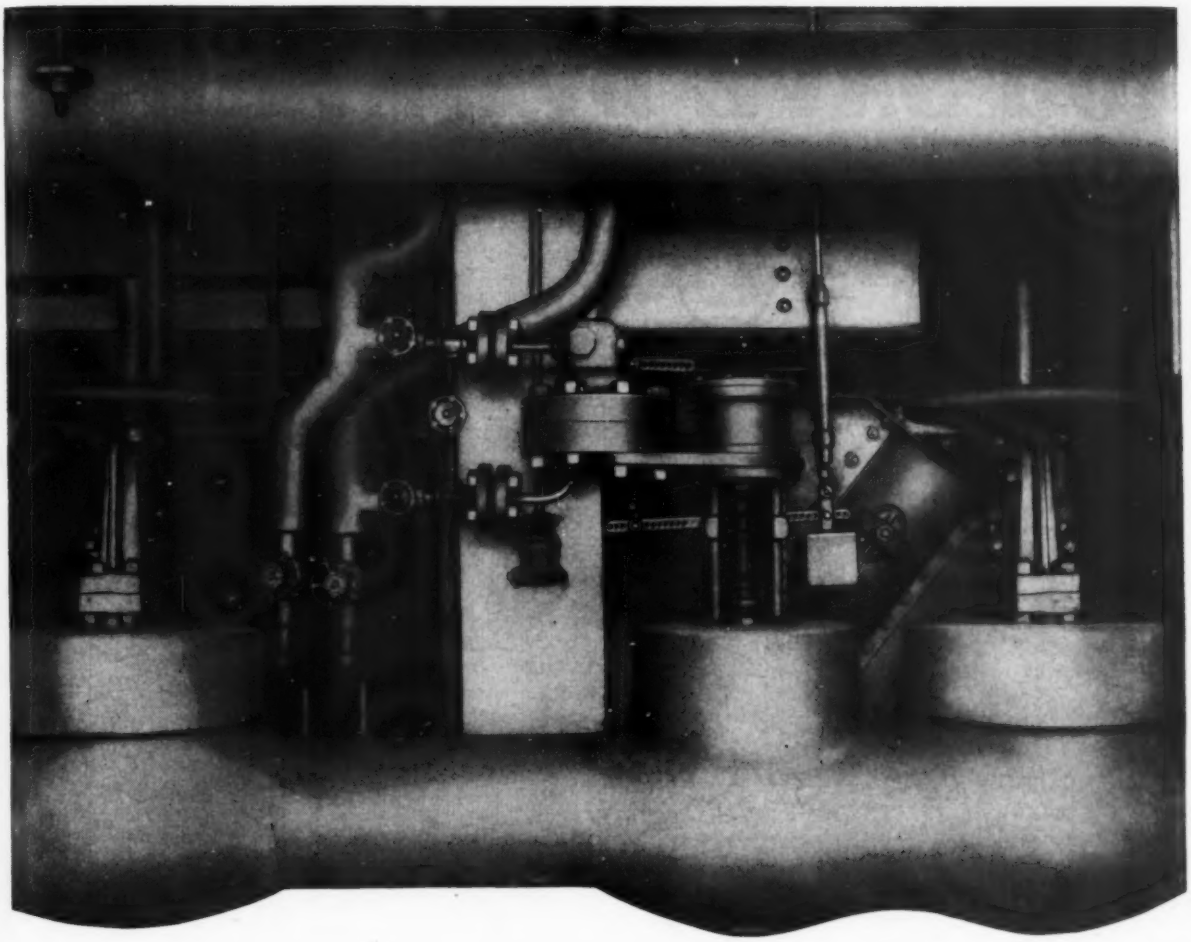


SKF Spherical Roller Bearings have been specified for most of the major tunnel-fan installations because they're self-aligning . . . long-lived . . . require infrequent lubrication and inspection . . . give continuous trouble-free service under highly adverse conditions. SKF *Industries, Inc., Philadelphia 32, Pa., the Pioneers of the Deep Groove Ball Bearing, Spherical Roller Bearing, Self-Aligning Ball Bearing.* 7073

SKF
BALL AND ROLLER BEARINGS

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

INTEGRITY — CRAFTSMANSHIP — METALLURGY — TOLERANCE CONTROL
SURFACE FINISH — PRODUCT UNIFORMITY — ENGINEERING SERVICE — FIELD SERVICE



How to hold boiler water level closely

When you want to hold boiler water level within close limits, no matter how widely or rapidly loads change, depend on COPES Flowmatic—the simplest, most widely used flow-level type of feed control.

This industrial installation, for example, is on a 660-psi Riley Steam Generator rated at 225,000 pounds per hour. Loads constantly fluctuate 10,000 pounds per hour over a total range from 150,000 to 265,000 pounds per hour. Yet water level is held within plus-or-minus one inch at all times.

More than 1200 Flowmatic users like the coordination of influences from steam flow and water level to get the exact feed needed for close level control. They also like the ease with which plant personnel can handle all maintenance.

For a complete performance report on installation illustrated above, write for Bulletin 485.

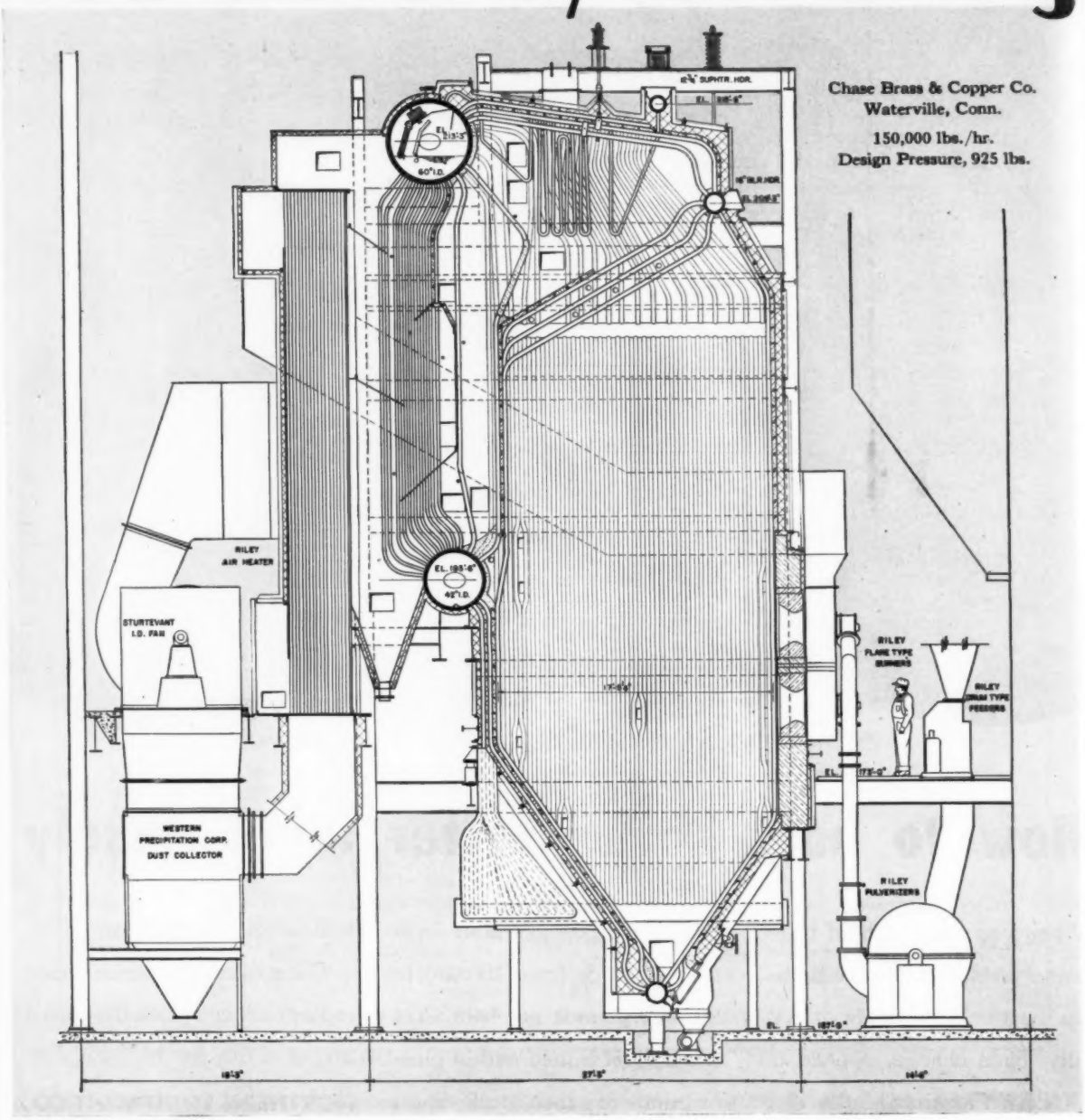
NORTHERN EQUIPMENT CO.
404 Grove Drive, Erie, Pa.
BRANCH PLANTS: Canada, England, France, Austria, Italy. *Representatives Everywhere*

COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

You SAVE by installing



TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

this unique RILEY Unit

by reducing building height

With this design of Riley unit for a given steam capacity the required building height is reduced by a minimum of five feet under that required with older designs. This saves not only in building costs if a new building is being constructed, but also reduces the cost of supporting steel for the boiler unit. If the unit is being installed in an existing building a higher capacity unit can be installed.

by eliminating cost of separate ash hopper

The requirement of a separate ash hopper is completely eliminated with this design, not only saving the cost of such a separate hopper but also foundations or supporting means.

by eliminating cost of seals between unit and ash hopper

Seals between the steam generating unit and ash hopper and alloy drip castings are eliminated with this design. This design not only saves the cost of these items but also eliminates maintenance of them.

also reduces maintenance

As no separate ash hopper is required, maintenance of the ash hopper is eliminated. Likewise, troublesome maintenance and corrosion of seals and drip casting is eliminated.

and increases efficiency

With this Riley design there is no loss of efficiency due to evaporation of water where that type of ash handling system is employed. This often represents a material fuel saving.

lowers cost without sacrifice of operating advantages

These significant initial investment costs are saved without sacrificing in any way the operating advantages of the older designs. Users invariably report entire satisfaction and ease of ash removal with this design. Again Riley has made a significant contribution in decreasing the cost of steam generation.

All of these companies have ordered Riley Single Header Hopper Bottom Units

*Carnegie Illinois Steel Corp.
Chase Brass & Copper Co.
*Celanese Corp. of America
Norton Company
*Esso Standard Oil Co.
Bird & Sons
American Viscose Corp.
Great Lakes Steel Corp.
Northern Paper Mills
Chevrolet Motor Co.
Waldorf Paper Products Co.
Cities Service Corp.
*Hooker Electrochemical Co.
Calumet & Hecla Consol. Mining Co.
Riegel Textile Corp.
Savannah Sugar Refining Co.
Monsanto Chemical Co.
New Orleans Public Service Co.
Gould Paper Co.
Champion International Co.
*Central Ohio Light & Power Co.
*Otter Tail Power Co.
Upper Michigan Power & Light Co.
Ware Industries
C. H. Masland & Sons
Milwaukee Forge & Machine Co.
City of Danville, Va.
City of Holyoke, Mass.
City of Los Angeles, Calif.
City of Rochester, Minn.
*Dairyland Power Corp.

Repeat Orders

These Consultants have engineered Riley Single Header Hopper Bottom Unit projects

Sargent and Lundy
Ebasco Service, Inc.
United Engineers & Constructors
Day & Zimmerman, Inc.
Chas. T. Main, Inc.
Vern E. Alden
Rust Engineering Co.
Albert Kahn
Douglas M. McBean
Sill and Warrington
W. I. Barrows
Arthur G. McKee & Co.
M. W. Kellogg Co.
Harrison G. White
Oscar A. Kiss
Helmick, Edeskuty & Lutz
McClintock & Craig
Egli & Gompf, Inc.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your ... costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

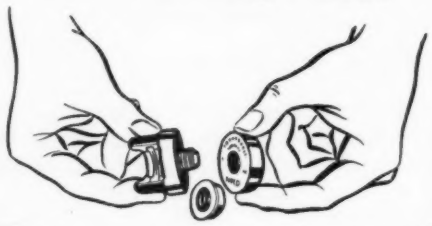
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD ... SETTINGS • AIR HEATERS

A versatile valve for general service . . .

LUNKENHEIMER
Figure 123
N-M-D Non-Metallic Disc

150 lb. S.P.
300 lb.W.O.G.

The valve with the quick-change disc



STEAM • HOT WATER • COLD WATER
AIR AND GAS • GASOLINE • OIL • BUTANE • PROPANE

Ultra-modern Manufacturing Facilities

From raw material control to final testing, new machinery, methods and research improve the quality and speed the making of Lunkenheimer Valves. New production equipment, like the group of medium ram type turret lathes shown here, is but a small part of Lunkenheimer's extensive improvement program to provide users with the best possible valve service.

Fig. 123 is an exceptionally rugged valve . . . available with various types of discs especially compounded to give top results on the services for which they are recommended. Discs can be renewed or interchanged quick as a wink, insuring long-time satisfactory valve service with negligible maintenance expense. Disc holder is slip-on type, perfectly guided. Hexagon head gland is an aid to easy repacking. A further economy feature is the distinctive, long-wearing stem material developed by Lunkenheimer, eliminating stem-thread failure due to wear.

The "N-M-D" valve is also regularly available in angle, check and quick operating patterns. Circular No. 558, descriptive of the complete line, is yours for the asking.

N. M. D. and other Lunkenheimer Valves are available in all industrial centers. You can depend upon your Lunkenheimer Distributor for prompt service on your requirements.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

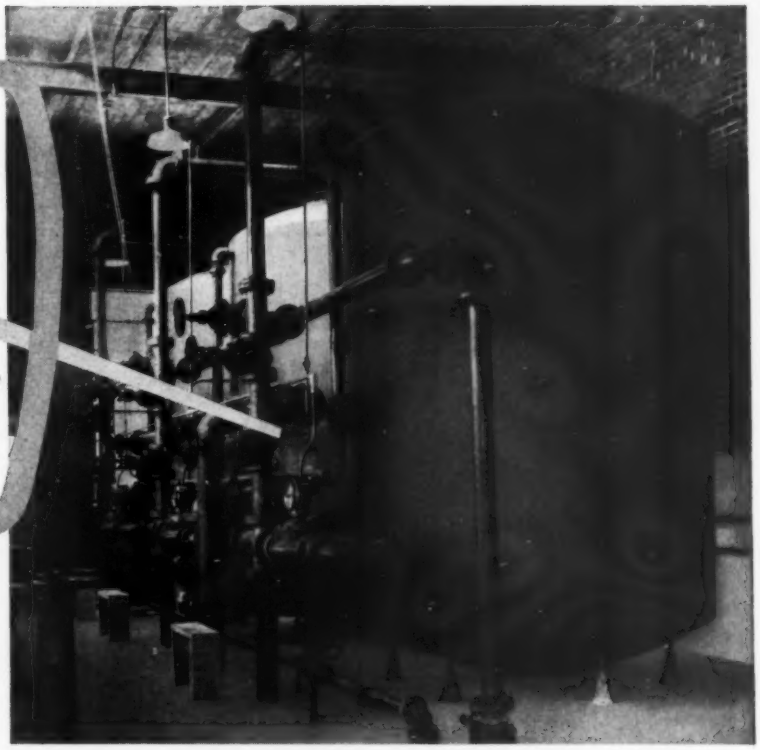
"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

ZEOLITE is right for purifying water here...



Worthington installation of three 8′ — 0″ dia. Sodium Zeolite Softeners put into operation in August, 1948 at Virginia Woolen Co., Middlebury, West Virginia. Here raw creek water is alum treated, settled, filtered and softened. Virginia Woolen Co. constructed its own filters.

. . . but it may not be right for <u>your</u> water treatment

This Worthington Ion-Exchange plant was installed for purifying water in this case, *only* after scientific analysis by Worthington engineers determined that it was the most economical process for Virginia Woolen Co.

In your case, there are so many variables involved that a similar analysis would have to decide which water conditioning process is right for you. Even within the ion-exchange process itself, there are many variables: what ions you want to get rid of . . . calcium, magnesium, sodium, bicarbonate, sulphate or chloride; whether or not you want alkalinity removed; whether you want ionized water comparable to distilled water. *Only* scientific study of your particular water conditions can determine the right process for you.

WORTHINGTON KNOWS ALL FOUR PROCESSES

Out of Worthington's century-old experience in engineering water handling equipment has come more knowledge and skill in solving complicated water conditioning problems than you can get anywhere else. And since Worthington alone makes every essential part of all kinds of water conditioning systems, you get the extra advantage that comes from placing complete control and responsibility in the hands of one reliable manufacturer.

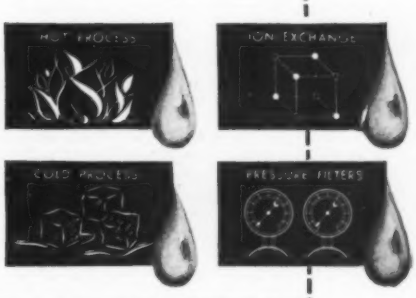
For complete details about the Worthington Ion-Exchange process, and further proof that *there's more worth in Worthington*, write for Bulletin W-212-B4. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, New Jersey.*

J8-8

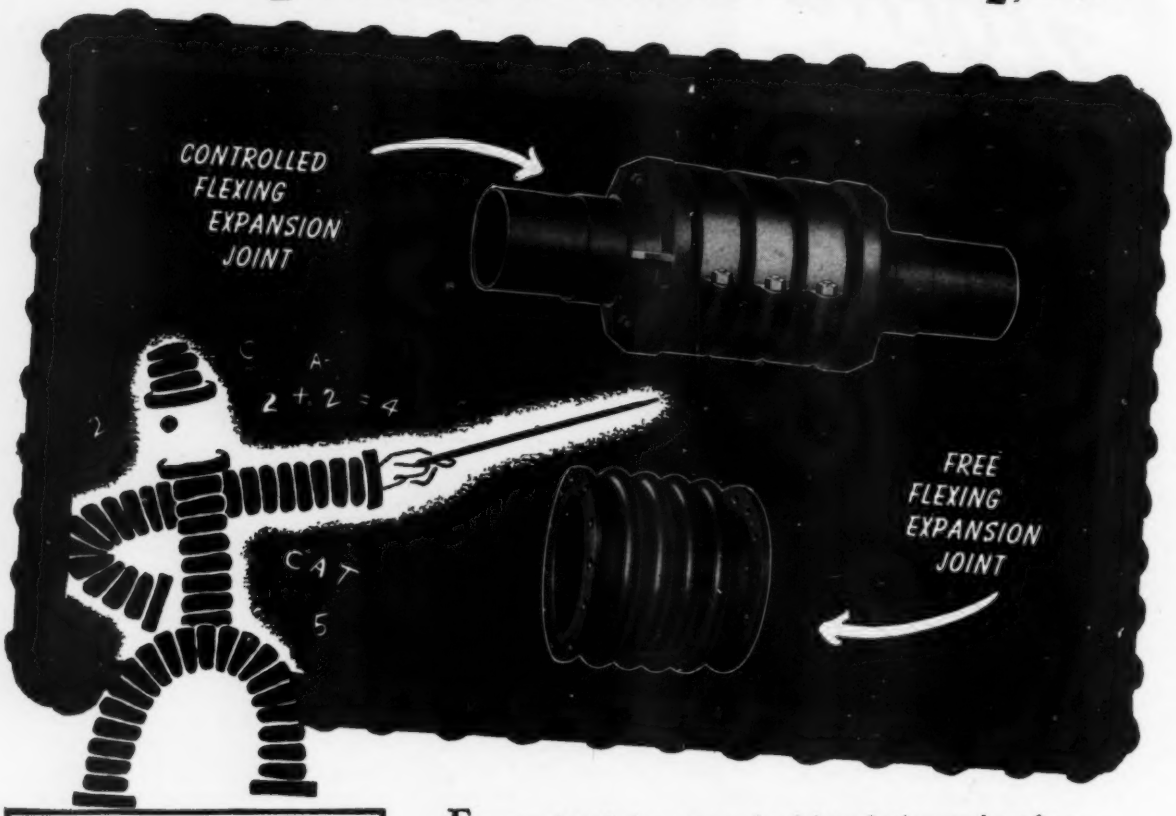
WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



Let CMH simplify expansion control for you



CMH FREE-FLEXING EXPANSION JOINTS for pressures to 30 psi.; temperatures to 1400° F. Sizes to 24" I.D. Flanged or welding ends.

CMH CONTROLLED-FLEXING EXPANSION JOINTS with precision mated control rings for pressures to 300 psi.; temperatures to 1400° F. Sizes to 24" I.D. Flanged or welding ends.

CMH FLEXONIFLEX EXPANSION JOINTS for pressures in the 1000 psi range can be furnished. Recommendations will be made on receipt of installation details.

For most installations, expansion joint selection need not be a complicated task. CMH has reduced the expansion joint selection problem to a matter of charts from which the joints necessary to meet your requirements may be selected quickly and easily. For unusual installations CMH offers its "Engineered Application Service" in which competent piping specialists will analyze your problems and make recommendations.

Whether your requirements are "run of the mine" or "one in a million" . . . for a new installation or replacement of obsolete equipment . . . CMH will make it easier for you to get the *right* expansion joint.

CMH—ONE dependable source
for every flexible metal hose requirement

• CMH manufactures all standard types of flexible metal hose, both convoluted and corrugated, in a variety of metals; expansion joints for piping systems; stainless steel and brass bellows; various conduits and special assemblies of these components.

CHICAGO METAL HOSE CORPORATION
EXPANSION JOINT DIVISION

Leaders in the Science of Flexonics
MAYWOOD, ILLINOIS
1345 S. Third Avenue
Plants at Maywood, Elgin and Rock Falls, Illinois
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ontario
FLEXON . . . . . identifies CMH products which have served industry for more than 48 years

are **coil failures** *costing you money?*

look at this record!

NOT 1 *coil failure*

in 2 years with National special class H coils

"Still operating beautifully," is the report *two years after installation* on the National silicone-glass-mica armature coils of the motor shown above. They were installed January 7, 1948, in the National shop. That's quite a record, following the 18 failures in 8 years listed at the right above.

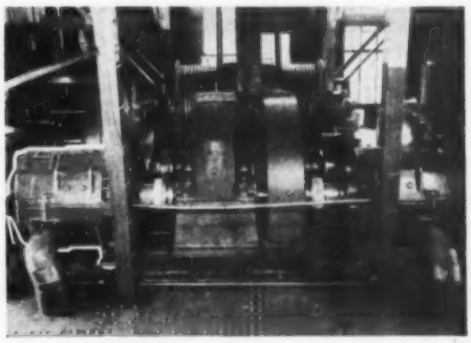
The motor is, of necessity, subjected to terrific abuse, since it is a hoist motor on a huge coal stripping shovel which often bites into solid rock. Excess heat burned out the coils monotonously . . . until National installed the special coils.

Special National Class H coils such as these are building up amazing records wherever high heat is a problem. They utilize silicone, melamine, glass, mica, MICA-GLAS, high-heat varnishes, special solders and other inorganic materials. The insulating materials are made in our plant to our rigid specifications. And all National coils fit snug and tight. They last.

Many armature burn-outs can be avoided by the use of higher grades of insulation. However, all-inorganic insulation isn't always the entire answer. Improved ventilation, better heat conductivity and other factors are also of importance. Your nearby National Field Engineer knows. Write for his name.

18 *failures in 8 years with regular insulation*

Date	Cause of Failure
2/21/40	Armature coils grounded
12/29/40	Armature coils grounded
9/2/41	Open armature circuit
4/13/42	Armature coils grounded
4/18/42	Leads loose in commutator
10/24/42	Armature band thrown
4/5/43	Armature coils grounded
8/9/43	Open armature circuit
10/7/43	Armature coils grounded
9/30/44	Armature coils grounded
10/18/44	Armature coils grounded
7/28/45	Armature coils grounded
9/14/46	Armature coils grounded
2/6/47	Armature coils grounded
6/23/47	Armature coils grounded
9/17/47	Armature coils grounded
11/4/47	Armature band thrown
12/26/47	Armature coils grounded



Part of the interior of the strip shovel is shown above. The motor outlined is the one which caused so much trouble and expense before National special Class H coils were installed. A larger view of the same motor is shown in the photo at the upper left.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

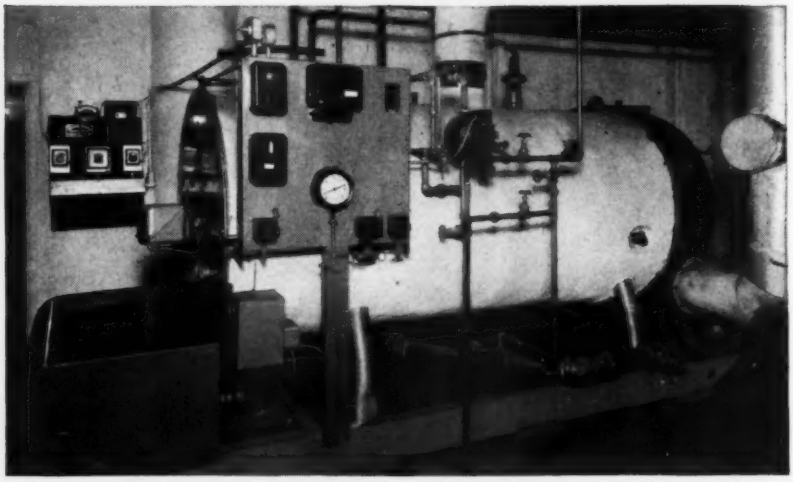
ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION—REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

STEAM-PAK

YORK 45 POWER

GENERATOR

A PRODUCT OF YORK-SHIPLEY



FUEL AND LABOR SAVINGS . . . "We consider the installation of the York Steam-Pak Generator one of the finest improvements ever made to our building. The saving in fuel and the saving in cost of labor is very noticeable. It is by a large margin more efficient than our coal stoker unit that we operated for several years and which we were always pleased with." Jonas Shure, Treasurer, Wm. H. Bradford Co., Boston.

SUBSTANTIAL SAVINGS

result from

- "Steam-Pak" efficient three-pass boiler construction.
- "Steam-Pak" automatic operation with varying loads.
- "Steam-Pak" rapid steam production.

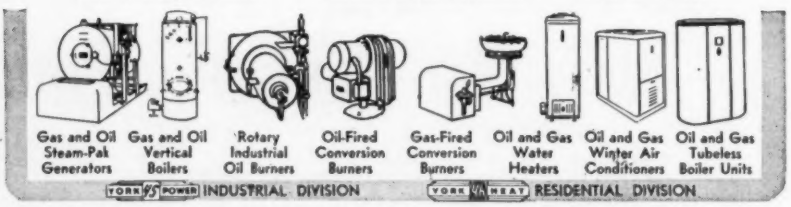
PLUS *iris shutter* precise metering and rapid mixing of air and fuel in "Steam-Pak" burners — see Iris Shutter explanation at left.

"Steam-Pak" Generators are built in capacities from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil, or straight gas. Ask for Bulletin No. 37-43. See your nearest York-Shipley dealer, or write, 'phone or wire

YORK-SHIPLEY

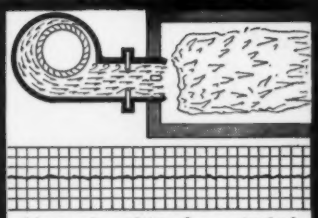
INDUSTRIAL DIVISION

316 Jessop Place, York, Pennsylvania — 'Phone 7861

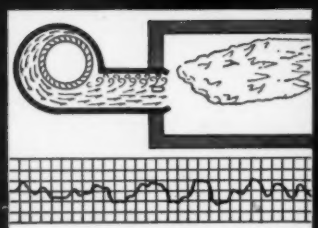

Gas and Oil Steam-Pak Generators
Gas and Oil Vertical Boilers
Rotary Industrial Oil Burners
Oil-Fired Conversion Burners
Gas-Fired Conversion Burners
Oil and Gas Water Heaters
Oil and Gas Winter Air Conditioners
Oil and Gas Tubeless Boiler Units

YORK 45 POWER INDUSTRIAL DIVISION — YORK WINTAIRE RESIDENTIAL DIVISION

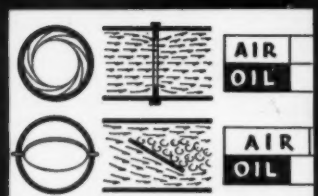
WITH *Iris Shutter* WATCH DOG OF BOILER EFFICIENCY



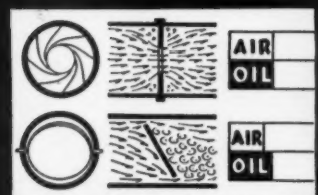
Above is pictured a typical burner WITH Iris Shutter control. Graph and flame illustration show the even flame and practically perfect control of air through your entire range.



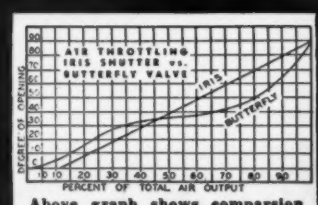
Burner without Iris Shutter shows air turbulance and uneven flame with fluxuating air volume indicating poor control.



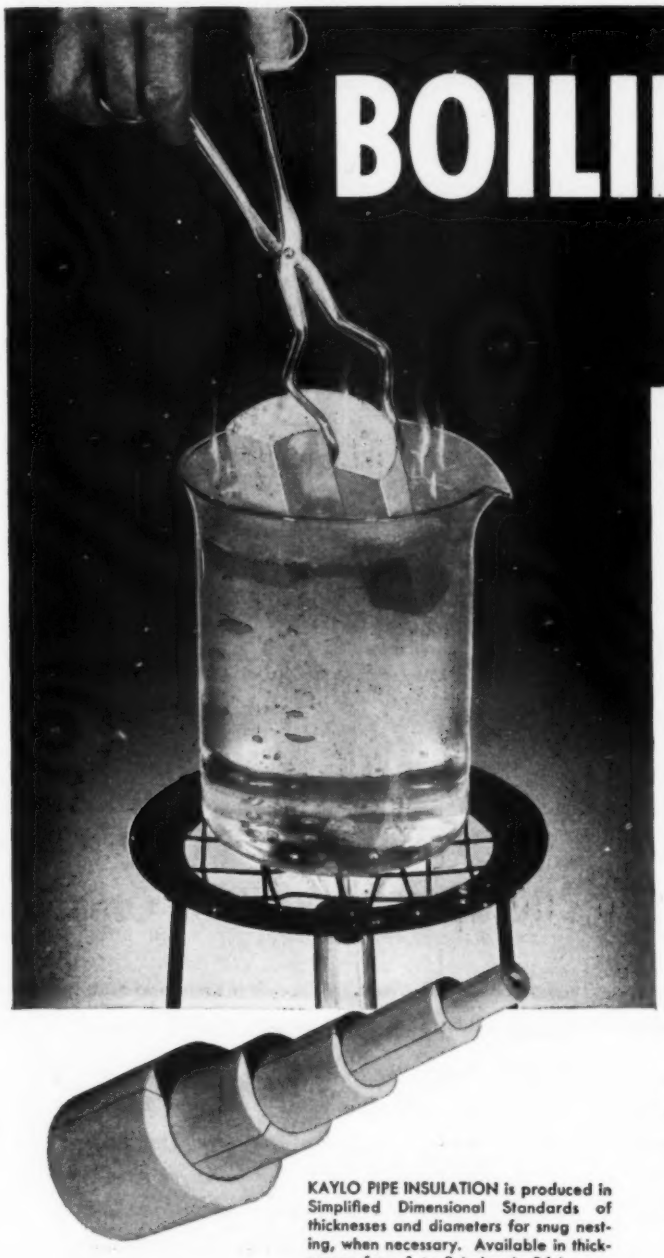
Control of air volume through Iris Shutter versus butter-fly valve at 60% angle of opening.



Control of air volume through Iris Shutter versus butter-fly valve at 30% angle of opening. Note difference in volume control of air and oil.



Above graph shows comparsion between Iris Shutter and butterfly valves normally used in oil or gas burners. Note the perfect control with Iris Shutter.



BOILING TEST

PROVES STABILITY OF KAYLO HEAT INSULATION

What insulation material will not break down under exposure to live steam or hot liquid? Answer: Kaylo Heat Insulation.

In tests, samples of Kaylo Heat Insulation have been boiled continuously for 24 hours and longer. None has disintegrated or shown any loss of insulating efficiency, after drying. Test boiling has caused no appreciable shrinking, swelling, weight loss or permanent change in Kaylo Heat Insulation.

This Inorganic Material Insulates Efficiently From 200° F. to 1200° F.

One layer of Kaylo Heat Insulation assures you of insulating efficiency from 200°F. to 1200°F.—a temperature range which often requires two thicknesses of different materials . . . and the efficiency of Kaylo insulation actually improves after exposure to service temperatures.

This remarkable new product is available in two forms: Kaylo Heat Insulating Block and Kaylo Pipe Covering. Both are exceptionally strong, lightweight and resistant to moisture damage . . . easy to handle and apply . . . neat and clean in appearance on finished jobs.

The many advantages offered by Kaylo Heat Insulation are appreciated by users in many different industries.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary. Available in thicknesses from 1 to 3 inches in 36-in. sections, for pipe sizes from ½ to 12 in.

KAYLO®

HEAT INSULATING BLOCK and PIPE COVERING

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division • Toledo 1, Ohio

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SEND COUPON FOR KAYLO HEAT INSULATION SAMPLE & LITERATURE

OWENS-ILLINOIS GLASS COMPANY
Dept. N-77, Kaylo Division · Toledo 1, Ohio

Gentlemen: Please send me a Kaylo Heat Insulation sample and descriptive literature.

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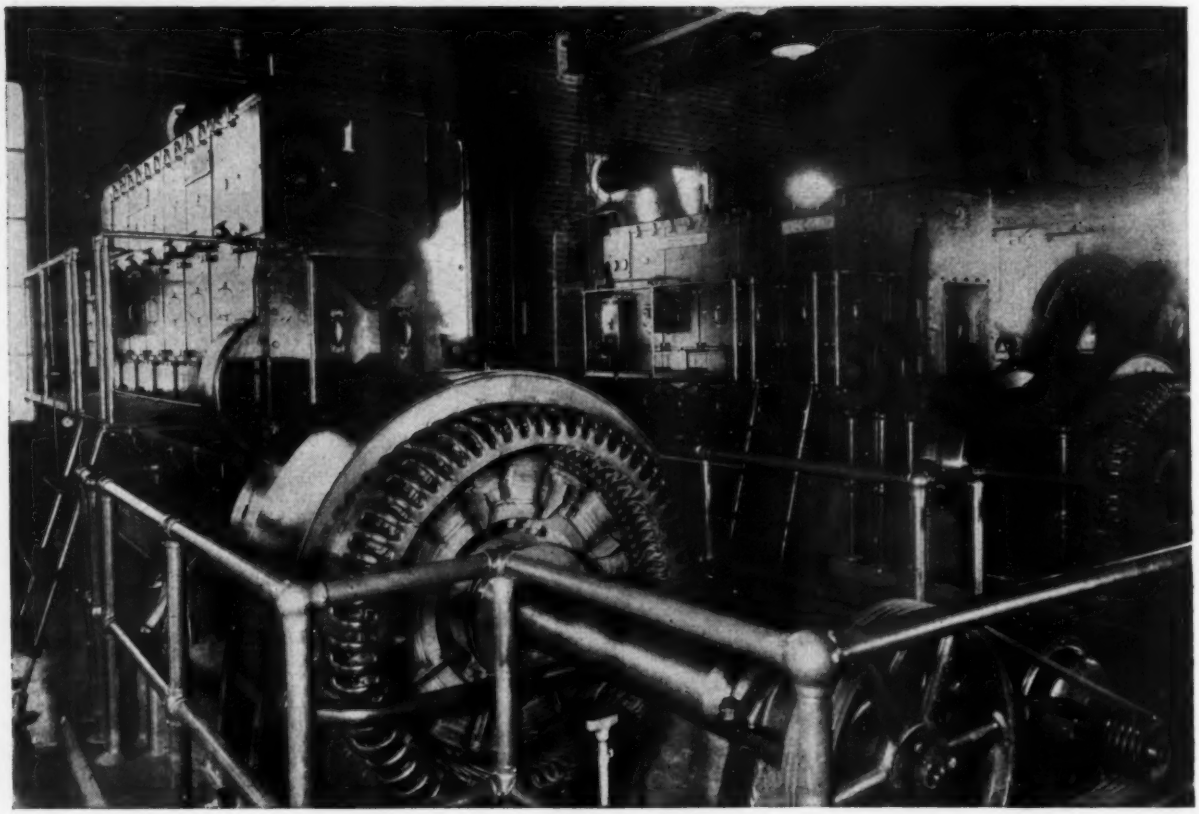


These Superior Engines Saved $20,000 Operating at 40% Capacity

In an Illinois town two Superior Dual Fuel engines have slashed electrical power costs. And it was done under adverse operating conditions.

Two identical turbocharged Dual Fuel Superior Diesels were fitted into the old steam generator building without disrupting service. And because the city fathers wanted ample capacity for supplying future current requirements, they purchased large units that would operate initially at partial loads.

In spite of the fact that this load factor averaged less than 40%, these two Superior Diesels saved $20,000 in their first year of operations. When natural gas becomes available soon, it is estimated that savings will increase an additional $10,000 a year.

If you're looking for ways to cut power costs or increase generating capacity, it will pay you to talk to a Superior representative. One will be glad to call on you at any time—just name the date. And, of course, we'll be glad to send you a copy of our new, fully illustrated booklet, *Superior Diesel For Stationary Application.*

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

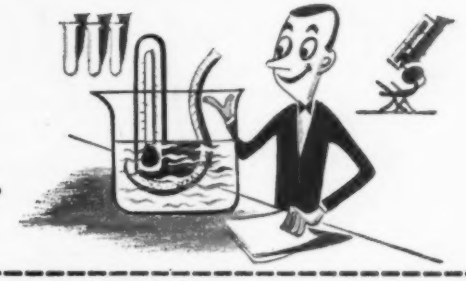
THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

For 3500 years,
ramie fiber resisted rot
in an Egyptian tomb...

Now...Johns-Manville makes ramie fiber into the rot-resistant packing...



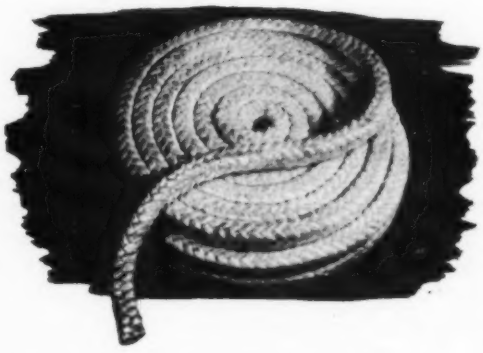
That's why *NAVALON* stands up where other packings fail!

IN PLANT AFTER PLANT, this new Johns-Manville packing made from ramie fiber is establishing new records in reciprocating service against fresh or salt water, brine, cold oil and many other liquids.

Navalon's rot-resistant properties are only one reason for these outstanding performance records. Navalon also has the high tensile strength inherent in ramie, nature's strongest fiber. An exclusive Johns-Manville process of manufacture gives it unusual lubricating properties, too—another reason for its ability to outlast other cold liquid service packings. And, in addition, Navalon is free from any tendency to score.

In the toughest service, users are finding that this unique combination of properties not only means less repacking—it means less wear on rods and plungers as well—money-saving performance all around.

Why not investigate Navalon as a means of increasing packing life and reducing costs in your plant? Get in touch with your packing distributor, or send for folder PK-32A that tells the full story. Just fill in the coupon below.



Johns-Manville
PACKINGS & GASKETS

Johns-Manville
Box 290
New York 16, N. Y.
Please send me your folder on Navalon Packing (PK-32A).

Name_____
Company_____
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City_____ State_____

fight off...

the 3 most common types of wear

√ ABRASION

The scraping type of wear... Plow shares, dredge pump blades, cinder crusher rolls and other parts that rub together or come in contact with gritty materials quickly wear out unless hard-faced.

√ IMPACT

The pounding type of wear... when metal parts smash together. Impact takes a heavy toll in shear blades, dies, punches, and hammers.

√ CORROSION

The pitting or corroding type of wear. Valve seats and disks, pump plungers, mixer blades, pellet mill plows are usually exposed to corrosion and abrasion.

with these new Hard-Facing Rods

Here are 3 new rods designed to meet the most severe conditions of wear. They are all easy to apply. Use them to hard-face the wearing parts of your machines and equipment.

"HAYNES" 90 ROD...

This rod is hard enough to resist abrasion... tough enough to stand up under impact without chipping or spalling, and will withstand temperatures as high as 1,000 deg. F. without crumbling or flaking off.

"HAYNES" 92 ROD...

The hardest of the 3 rods and the easiest to apply. HAYNES 92 has a low melting point that makes it ideal for hard-facing extra-large parts that are difficult or impossible to preheat. It is excellent, too, for hard-facing thin sections that might warp or buckle under too much heat... and it is extremely wear-resistant.

"HAYNES" 93 ROD...

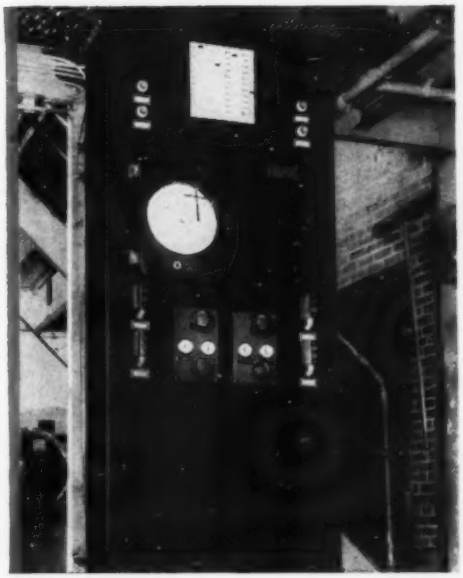
The rod with the highest alloy content of the three. More than 40% alloying ingredients make this the best of the 3 rods for resisting corrosion. It has a high cold hardness, too, and gives outstanding service when applied to parts like dredge pump impellers, slag crusher rolls, plow shares and other parts that must stand up under abrasion.

"Haynes" is a trade-mark of Haynes Stellite Company

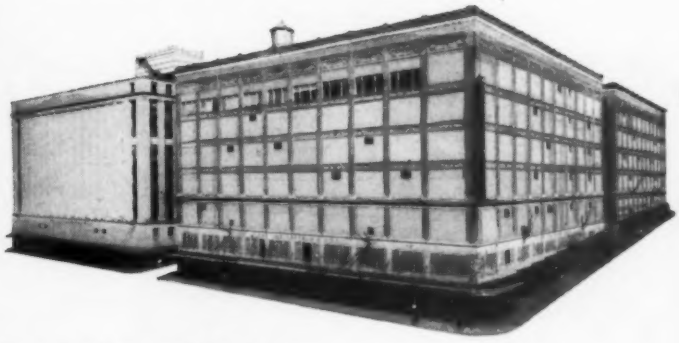
Order from your local Jobber

Or write us for his name and address. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y.

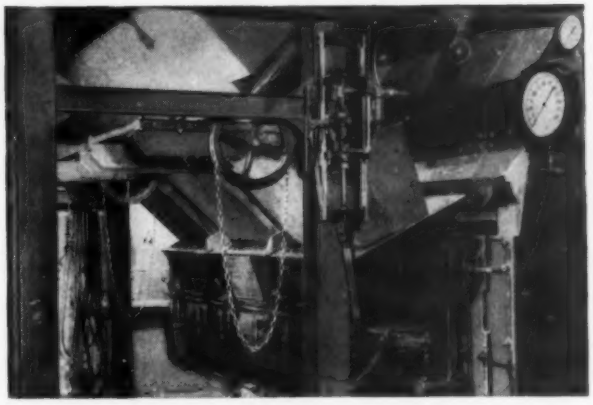
FIRST, HAGAN CONTROLS,
then HAGAN controls and meters . . .
AT F. & R. LAZARUS & COMPANY



Control panel of the new boiler at F. & R. Lazarus & Company, Columbus, Ohio, showing Hagan Ring Balance Boiler Meter.



The main buildings of F. & R. Lazarus Company occupy a full city block. Steam is used primarily for heating, but some is required for laundry and cooking.



View of front boiler. Hagan fuel control cylinder is shown in foreground. Boiler was installed by the manufacturer, Combustion Engineering Corporation. Edward E. Ashley of New York was consulting engineer.

The store of F. & R. Lazarus & Company in Columbus, Ohio—now managed by the fourth generation of the Lazarus family—would do credit to any city. Its main buildings now occupy a full city block, and additional buildings are used for special departments and services.

These main buildings represent an almost constant program of construction and modernization, which has been accompanied by necessary changes in the steam generating plant.

Hagan Control—a master sender, compensating relay, receiving regulators and balanced float controllers—was installed on two boilers in 1944.

Continued expansion of the store made further modernization of the boiler plant necessary, and in 1949 a new boiler was installed. This is stoker fired, has a capacity of 31,500 lb./ hr. and operates at a pressure of 125 psi.

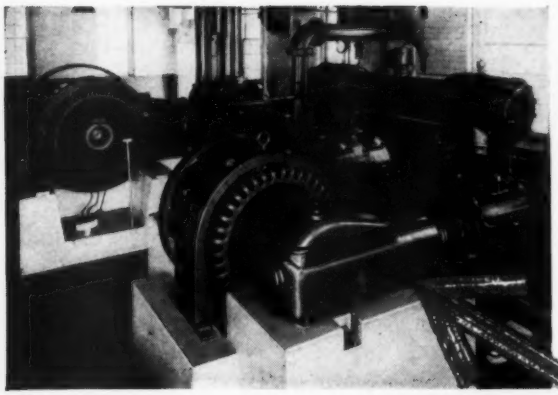
Hagan Automatic Combustion Control was installed on this new boiler, and a separate panel was provided. A Hagan Ring Balance Boiler Meter measures steam flow and air flow.

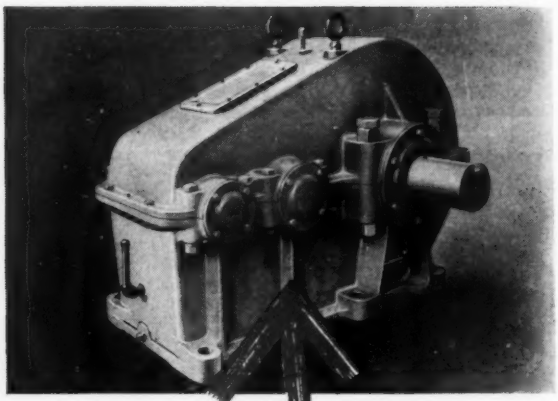
Both Hagan Controls and Hagan Ring Balance Meters are characterized by simplicity, accuracy and dependability. Because of these qualities they are giving eminently satisfactory service in steam generating plants of all types and sizes, in all parts of the country.

For full information on either meters or controls, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES





For the best lubrication use SINCLAIR RUBILENE

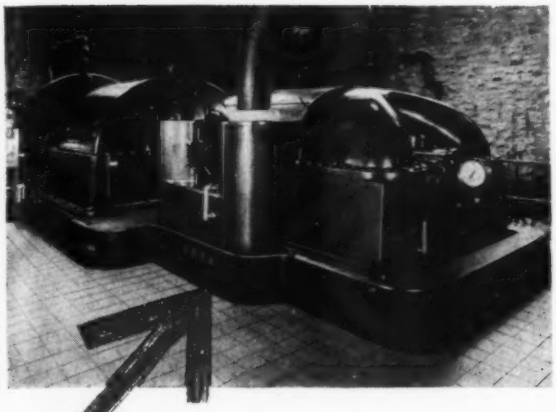
Over many years engineers in power plants throughout the country have accepted Sinclair's Rubilene as the finest available lubricant for power house equipment.

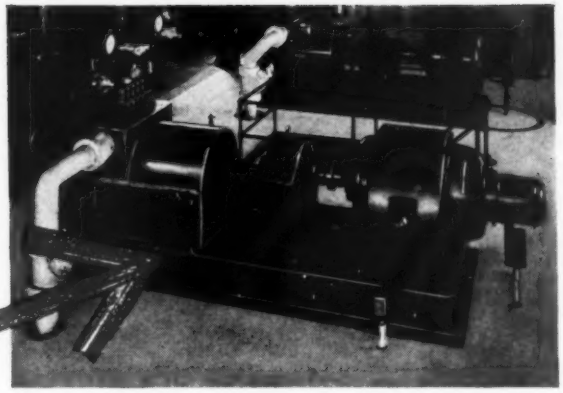
Sinclair Rubilene has always been a top-quality oil, as it has been constantly improved through the years, incorporating the latest technological developments in refining and processing. It resists oxidation under continuous high temperatures, and recirculation. It separates rapidly from water and is non-foaming. Through long periods of use it retains its original qualities, providing uniform, trouble-free lubrication and low maintenance costs.

Yes...Rubilene's finer quality pays dividends in the power plant.

SINCLAIR

For lubrication counsel . . . see your nearest





REFINING COMPANY

Supplier of Sinclair Products or write to Sinclair Refining Company, 630 Fifth Ave., New York 20, N. Y.

REDUCE PIPE LINE MAINTENANCE COSTS with CHAPMAN

TILTING DISC

Check Valves

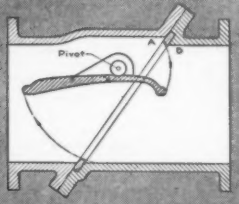
Because of their unique design, Chapman Tilting Disc Check Valves *close without slamming*. There is no water-hammer . . . no vibration of pipe lines or adjacent structure. Nor any danger of opening up pipe joints or rupturing pipe lines. All mighty important reasons why maintenance costs are bound to go down when you standardize on this valve with the cushioned closing.

Yet that's only part of the story. Chapman Check Valves also reduce head losses 65% to 85% over conventional type check valves. And, when installed on pump discharge lines, they not only make possible increased pipe-line capacity but also effect substantial power savings.

Why not send for bulletin with engineering data *today*?

THE CHAPMAN VALVE MANUFACTURING COMPANY

INDIAN ORCHARD, MASSACHUSETTS



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

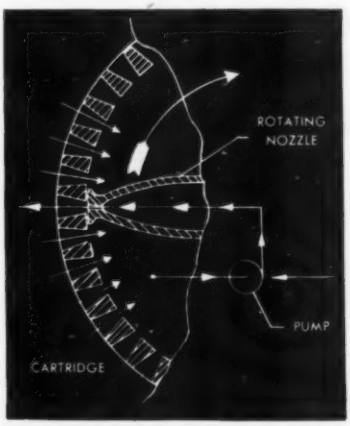
Save Water Automatically

and save money, too!

If water's scarce in your community, here's a painless way to cut down consumption.

If water isn't scarce yet, it's still expensive (particularly if you have to heat it or treat it), and here's an easy way to cut down its cost.

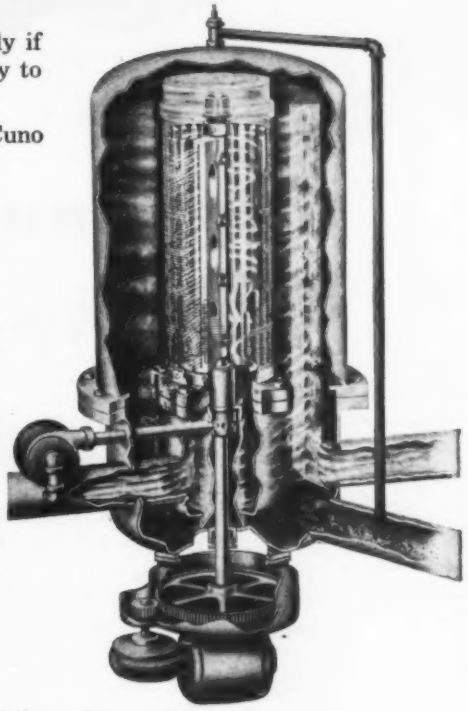
Make dirty water *fit for use* and *re-use* with a Cuno FLO-KLEAN Strainer.



Permanent, Resists Abrasion and Corrosion

Cuno Flo-Klean Filter makes raw water suitable for many plant services . . . keeps recirculated water clean . . . *pays for itself in as short a time as a year.* Permanent wire-wound cartridge positively removes all solids larger than spacing specified.* Pressure drop is exceptionally low because fluid moves in a straight line, encountering only momentary restriction.

**Available spacing from .0025 in. to .020 in.*



Continuously self-cleaning without fluid waste

There is no loss of backwash fluid. Used backwash is returned to the system. With no interruption of flow for cleaning the strainer, no duplex installation is needed. Operation, including sludge removal, may be completely automatic.

Find Out How to Save Money

cleaning any fluids containing abrasives

CUNO ENGINEERING CORPORATION
149 South Vine St., Meriden, Conn.

Please send information—without obligation—on Cuno FLO-KLEAN for application noted:

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Name.....Title.....
Company.....
Address.....
City.....State.....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

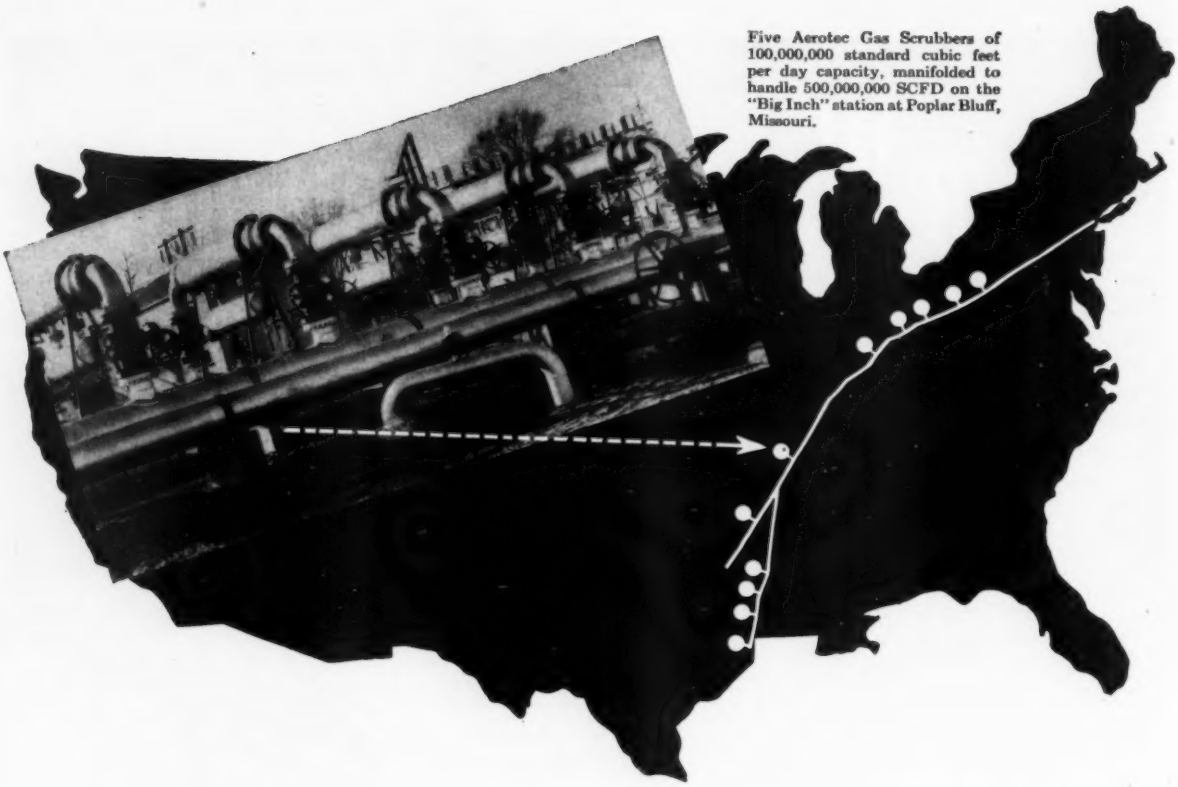
No Fluid Is Better Than Its Filtration

CUNO

Complete Line Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

MICRONIC (MICRO-KLEAN) DISC-TYPE (AUTO-KLEAN) WIRE-WOUND (FLO-KLEAN)



Five Aerotec Gas Scrubbers of 100,000,000 standard cubic feet per day capacity, manifolded to handle 500,000,000 SCFD on the "Big Inch" station at Poplar Bluff, Missouri.

THE INDUSTRY SPECIFIES:

AEROTEC *Dry* GAS SCRUBBERS

On the "Big Inch" pipeline and at the wells, Aerotec Gas Scrubbers are performing with unparalleled efficiency the job of keeping pipelines free of dust, liquid and distillates.

Based on a dry process of separating foreign material from gas, the Aerotec method eliminates the need for a cleaning medium, insures a minimum carryover of foreign matter into the gas stream. Units are available in practically any size up to 100,000,000 SCFD. Larger capacities may be handled by manifolding these standard units to any desired capacity.

Acceptance of Aerotec Gas Scrubbers is best demonstrated by the rapidly growing list of new users. Repeat orders prove that the Aerotec method is setting a new standard for an industry where maximum efficiency is required.

Complete information on this new method is now available.
Write for Catalog 501-2W today!

Project and Sales Engineers

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Greenwich, Connecticut
(Offices in 28 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St., W., Montreal 25, Quebec

THE AEROTEC CORPORATION

GREENWICH, CONN.

ALL YOUR
QUESTIONS ANSWERED
about correct steam trapping

Here's a book that is especially prepared to answer all your questions about correct trapping of steam lines. Filled with helpful reference data, "Solving Steam Trap Problems" saves your time and money by giving you easy-to-follow formulas for proper trap selection. This book also contains many helpful hints on how to keep equipment at top efficiency by removing all condensate and air, as well as how to install and service traps. This valuable book is yours without cost. Simply attach coupon to your business letterhead and mail.

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MAIL COUPON BELOW

HOW CAN I SELECT THE RIGHT TRAP FOR ANY INSTALLATION?

This 36-page book makes it easy to specify the correct steam trap. You'll save time and money by being able to determine the right trap for any installation in just a matter of minutes.

HOW MANY FITTINGS CAN I SAVE PER INSTALLATION?

It is no longer necessary to use three elbows and four nipples for the average steam trap installation. "Solving Steam Trap Problems" shows how to install a trap with a single fitting, saving 60 minutes of installation time.

WHY IS IT IMPORTANT TO TRAP UNIT HEATERS?

Learn how to get maximum heat from unit heaters! The heat delivery of a unit heater depends, among other things, on how completely the steam compartment is filled with dry hot steam. The correct method of trapping unit heaters to obtain maximum efficiency is fully explained.

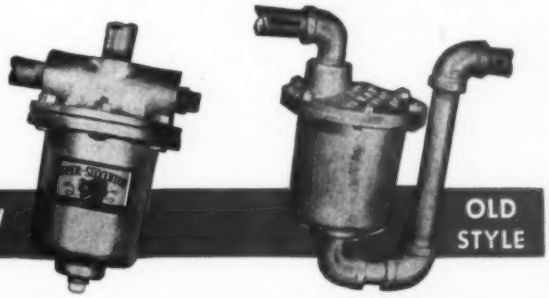
WHAT IS FLASH STEAM?

Flash steam is frequently mistaken for live steam and a steam trap condemned when it is still satisfactory. You'll find a complete explanation of flash steam and how to distinguish from live steam.

ALSO HOW CAN I DETERMINE THE RIGHT TRAP FOR

• Pipe Coils and Heating Surfaces in Still Air • Fan System Heating Surfaces • Steam Jacketed Kettles • Autoclaves • Submerged Surfaces • Hospital Equipment • Kitchen Equipment • Laundry and Dry Cleaning Equipment • and many others.

THE V. D. ANDERSON COMPANY
1950 WEST 96TH STREET • CLEVELAND 2, OHIO



Save Money With SUPER-SILVERTOPS

THE V. D. ANDERSON COMPANY
1950 WEST 96TH STREET • CLEVELAND 2, OHIO

Gentlemen: Please send without obligation your book "Solving Steam Trap Problems."

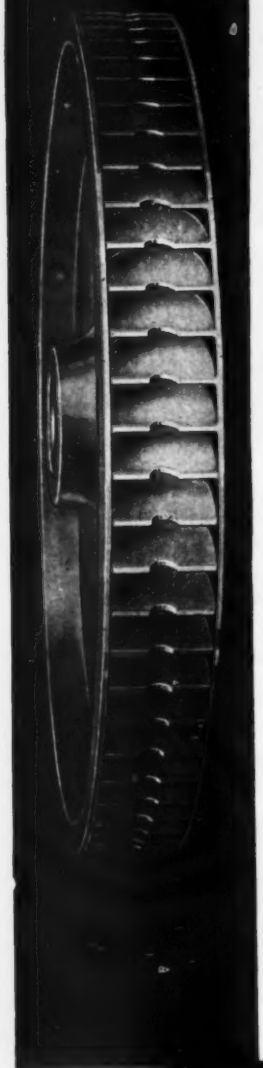
Name .....

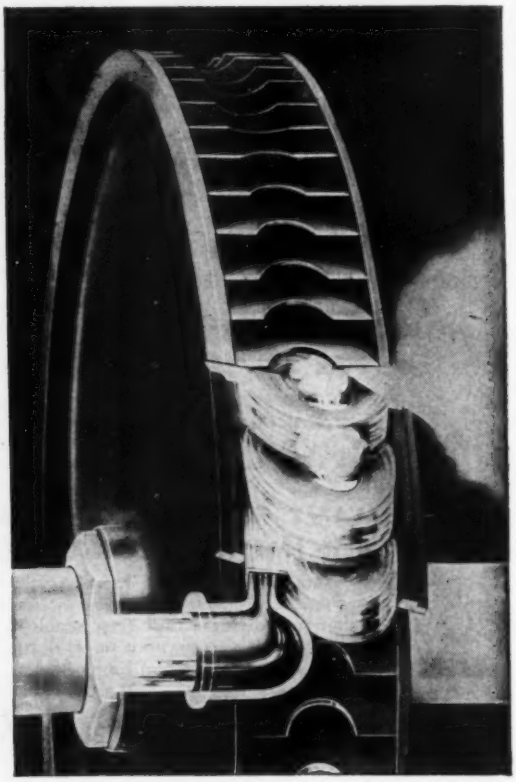
Address .....

City ..... *State* .....

In Canada: Bowden Machine Co., Toronto

TERRY





Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

NO PARTS TO LOOSEN OR WORK OUT

The rotor of the Terry Wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the solid curved backs of these buckets or pockets. Therefore close clearance is unnecessary and wear on the blades forming the pockets is of little consequence, as it does not materially affect horsepower or efficiency.

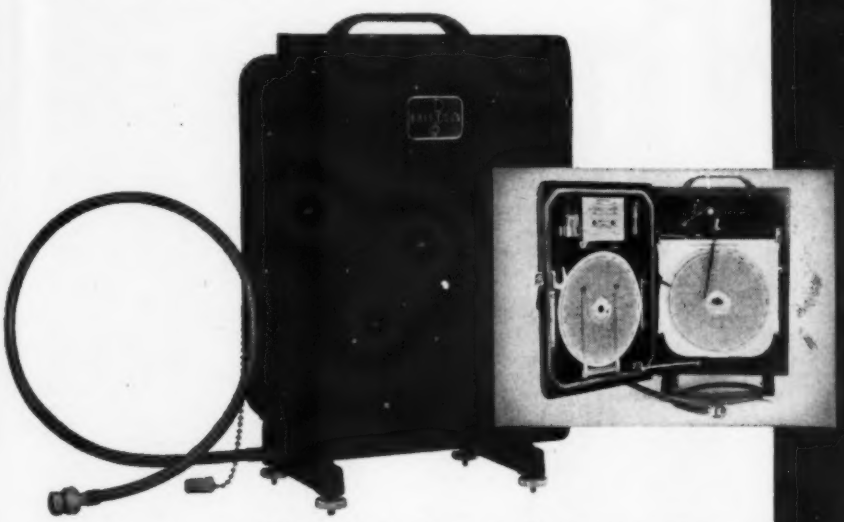
For detailed information about this effective construction and its advantages, write us on your business letterhead for a copy of Terry Turbine Bulletin S-116.

T-1172

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

...Hookup for trouble-shooters

Portable pressure gauges like this are used for testing and trouble-shooting. They must be easy to connect and disconnect quickly. The connecting tubing must remain tight despite severe and repeated flexing and abuse.



Bristol Series 500 Recording Pressure Gauge fitted with American Flexible Metal Tubing, synthetic covered.

In this case, the American Flexible Metal Tubing carries the medium tested (gas, vapor or liquid), instead of serving as armor over capillary tubing. The illustrated full interlocked flexible metal tubing, synthetic covered, meets this complicated and difficult assignment with ease and assurance.

There is a style of American Flexible Metal Hose and American Seamless Flexible Metal Tubing to convey nearly every fluid or gas over widely varied conditions of temperature, pressure or mechanical stress. For full information, write to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.

ANACONDA
from mine to consumer

wherever connectors must move... American

FLEXIBLE METAL HOSE AND TUBING

Look . . . NO STACKS!

P-D "Short Stacks" Become an Integral Part of This Michigan Power Plant

FAN STACK

PLATE TYPE AIR HEATERS

DUST COLLECTOR

THERMOBLOC INDUSTRIAL DIRECT-FIRED UNIT HEATERS

I.D. FANS

Here's modern industrial architecture at its best . . . a power plant with no protruding stacks.

This municipal power plant, close to the business district of Lansing, Michigan, was architecturally designed to give the appearance of a commercial building. Elimination of unsightly chimneys, an earmark of power plants, was accomplished by the use of specially designed P-D Fan Stacks, recessed into the actual building structure.

P-D Venturi type Fan Stacks are normally short, but these stacks were made even shorter by increasing the angle of the stack wall and dividing the stack with a baffle.

P-D Fan Stacks are a complete draft producing unit consisting of fan, breaching and stack, integrated to produce the highest efficiency attainable. Thus, predetermined draft efficiency can be guaranteed since all components are designed, engineered and manufactured by one company . . . The Prat-Daniel Corporation.

For the answer to your draft problem consult our project engineers . . . for modern, high induced draft efficiency, install P-D Fan Stacks.

Project and Sales Engineers

THE THERMIX CORPORATION GREENWICH, CONN.

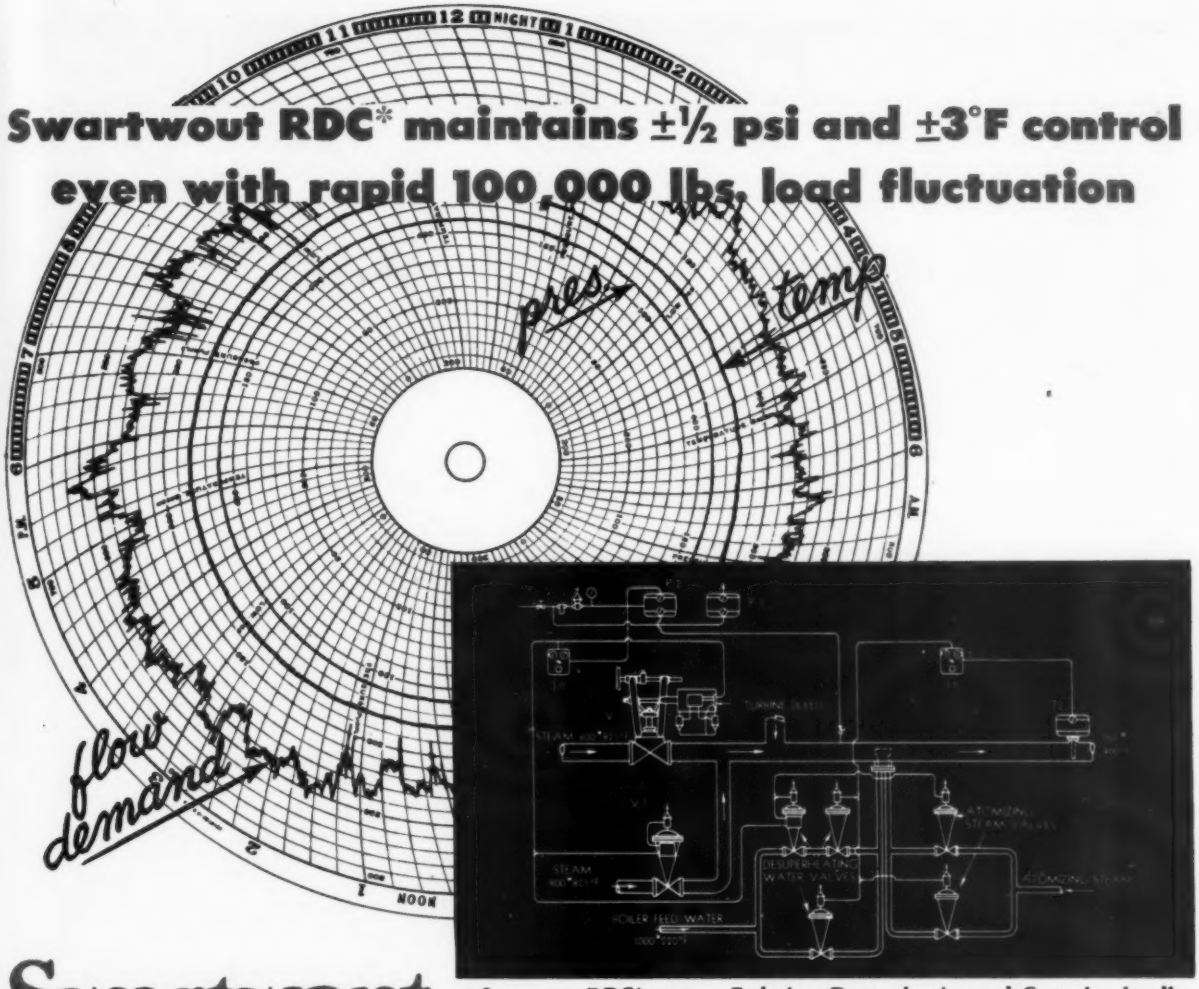
Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St. W., Montreal 25, Quebec

PRAT-DANIEL CORPORATION

69-4 WATER STREET EAST PORT CHESTER, CONN.

DESIGNERS AND MANUFACTURERS OF POWER PLANT EQUIPMENT FOR OVER 25 YEARS

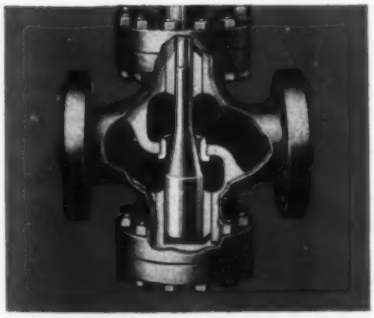
Swartwout RDC* maintains ±½ psi and ±3°F control even with rapid 100,000 lbs. load fluctuation



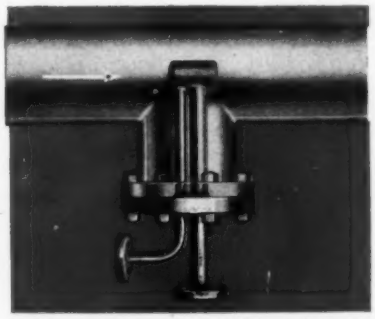
Swartwout

POWER PLANT EQUIPMENT

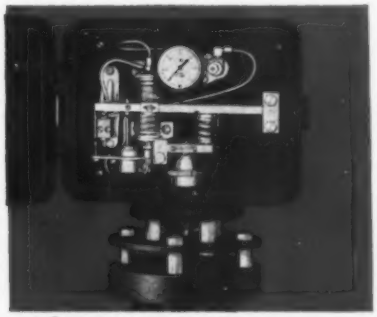
1 Swartwout RDC* system – Reducing, Desuperheating and Controls – handles fluctuating make-up load of up to 250,000 lbs. steam/hr. in a large Eastern paper mill. Initial conditions, 800 psi and 825°F; required final conditions, 160 psi and 460°F. Chart shows how Swartwout RDC system holds pressure to ±½ psi, temperature to ±3°F from minimum to maximum loads.



2 Swartwout V-1 valve *(above)* handles first 50,000 lbs. of load; V-3 then cuts in to handle 200,000 lbs. additional load. Valves reduce pressure from 800 to 160 psi without turbulence, vibration or undue noise. Correct design of disc, seat and throat eliminates high-velocity impingement and other destructive forces common to conventional reducing valves.



3 Swartwout steam atomizing desuperheater drops live steam temperature from 825°F, and varying extraction temperatures, to 460°F without pressure loss. Smooth-finished nozzle passages disperse atomized water outside head so that no erosion occurs. Narrow-angle atomization prevents thermal strains or cracks in piping, eliminates need for pipe liners.



4 Swartwout T2 direct-contact master control with reset for load compensation, sends temperature-proportional air-loading pressure through J-6 manual-automatic selector panel. Response to temperature change, within fraction of a second, assures precise temperature control regardless of load fluctuation or time lag.

A-2760

SEND FOR BULLETINS S-21-E, S-22-C, S-198 • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

It's new . . . inside and out

WARREN *Cradle Mounted* COMPACUNIT

? Do you want to handle corrosive materials that might injure the motor on a close-coupled pump?

? Do you want to use a standard or special motor or turbine?

? Do you want to use a V-Belt drive that will permit a wide range of speeds?

. . . then a Warren Cradle Mounted Compacunit could be the answer. This versatile, efficient and sturdy pump is built to "stand the gaff". . . and the price lower than you might expect for a quality product of this kind.

Sizes: 1", 1½", 2", 3"
Capacities: 5 to 450 G. P. M.
Heads: 15 to 500 feet
Materials: Standard, All Iron, All Bronze, or special to meet your requirements

Why not check this pump against your next pumping job, if within the indicated operating conditions? Ask for bulletin #242

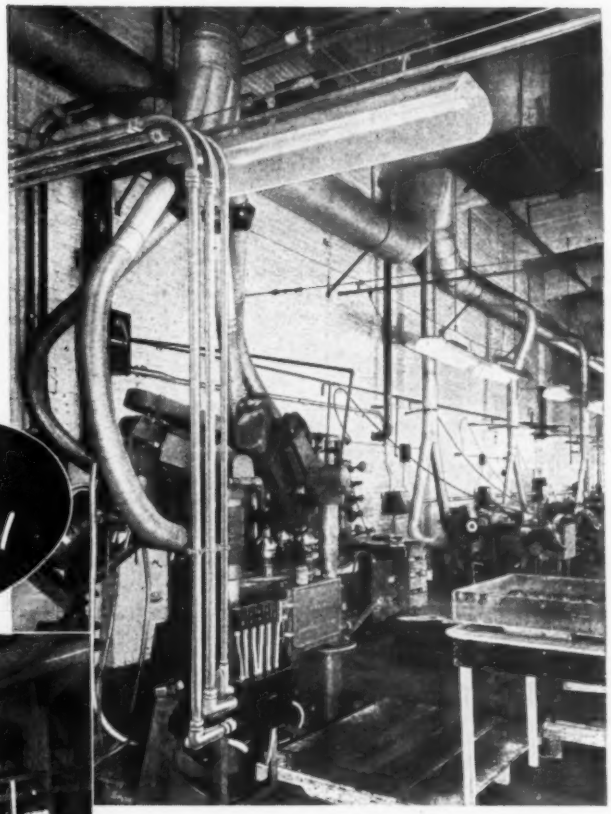
P-21

WARREN STEAM PUMP COMPANY, INC. WARREN, MASSACHUSETTS

WARREN Compacunit PUMPS

3 Problems— 1 Solution

... KIRK & BLUM!



Below: High velocity, double-slot hoods effectively pick up fumes as formed, remove sistant piping and exhausters.

Polishing Buffing Dust Control

Plating Fume Removal

Above: Dust Collecting System; note flexible connections permitting movement of automatic buffing and polishing machine. Below: Two-pass monorail conveyor through direct fired gas oven.

Enamel Baking Conveyor Oven

Illustrating Kirk & Blum's wide experience and money-saving ingenuity are these installations in the plant of a large auto accessories manufacturer. Three separate systems eliminate fumes from pickling and plating tanks, control dust in polishing and buffing operations and provide accurately controlled heat for enamel baking in a conveyorized overhead oven.

These are examples of the hundreds of systems designed, fabricated and installed by KIRK & BLUM. Turn your dust control, fume removal or low temperature oven problems over to experts with 40 years' experience.

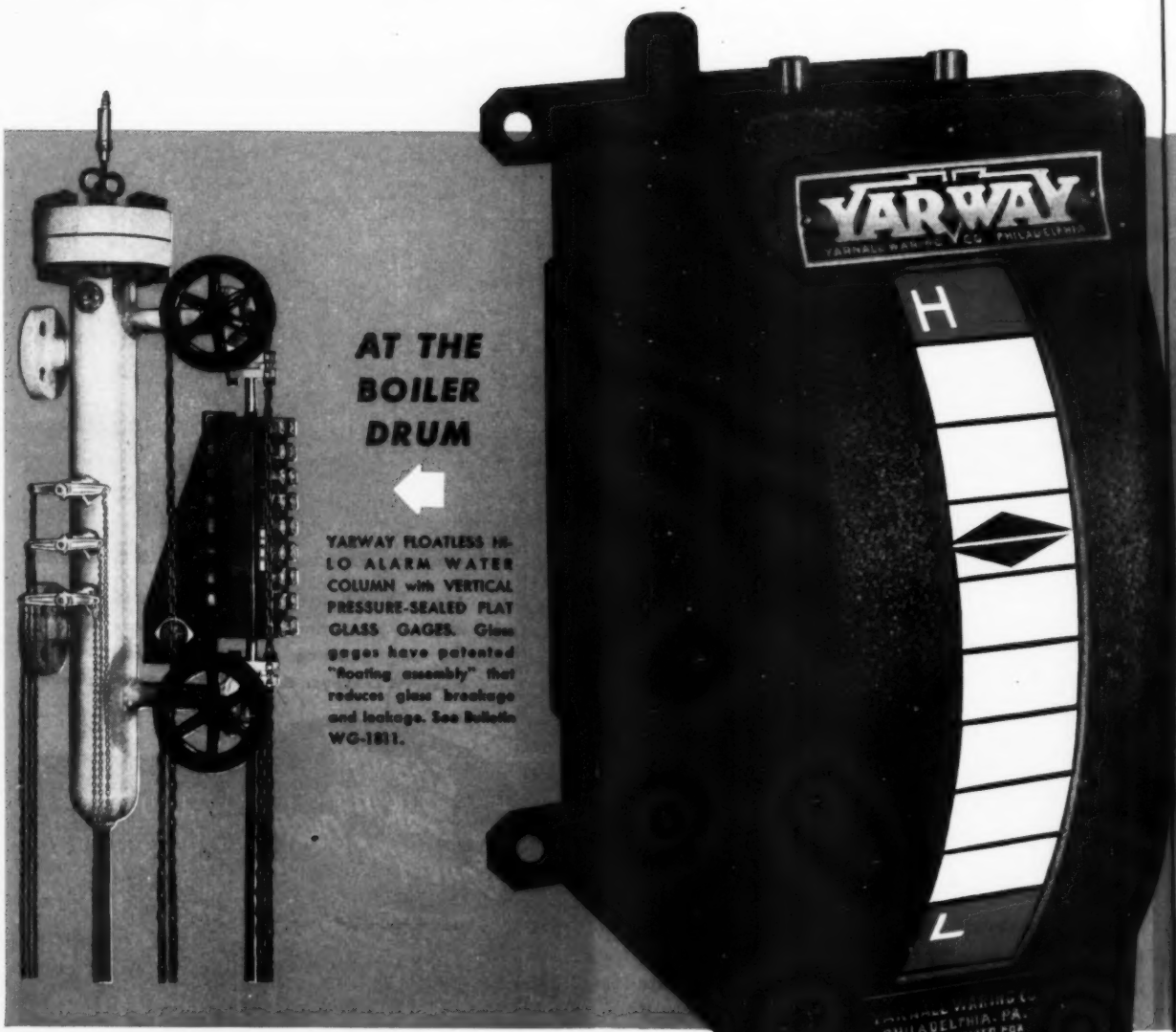
DUST AND FUME CONTROL SYSTEMS

INDUSTRIAL OVENS

KIRK AND BLUM

THE KIRK AND BLUM MANUFACTURING CO., 2874 Spring Grove Ave., Cincinnati 25, Ohio

Boiler Water Indication


AT THE BOILER DRUM
YARWAY FLOATLESS HI-LO ALARM WATER COLUMN with VERTICAL PRESSURE-SEALED FLAT GLASS GAGES. Glass gages have patented "floating assembly" that reduces glass breakage and leakage. See Bulletin WG-1811.
YARWAY
H
L
PHILADELPHIA, PA.
PATENT APPLIED FOR

YARWAY

ON THE LEVEL with a Yarway System

It's accurate! It's where you can see it!

These two most important needs for boiler water level indication are assured with a Yarway system.

Yarway indicating equipment is accurate because it is *operated directly by the boiler water itself*. Yarway Weight-operated Hi-Lo Alarm Water Columns with either Sesure Inclined or Flat Glass Vertical Gages take care of the job at the boiler drum. On the instrument panel or other desired location, Yarway Remote Liquid Level Indicators bring overhead gage readings down to convenient, easy eye-level vision. By use of a Control Unit on the indicator, additional Hi-Lo light or sound alarms can be located at any place in the plant.

The Yarway HI-LO-GRAPH, a panel-mounted *recording* indicator, gives a 24-hour record of boiler water levels.

Yarway engineers will gladly show you how the Yarway Boiler Water Indicating System increases power plant *safety* and *efficiency*.

For the full story on Yarway Indicators, write for a free copy of Yarway Bulletin WG-1822.

YARNALL-WARING COMPANY, 109 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES

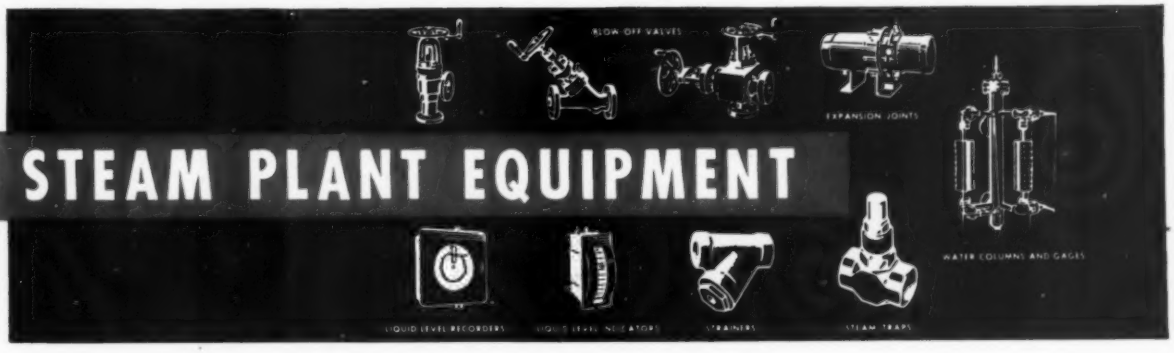
ON THE INSTRUMENT PANEL

YARWAY REMOTE LIQUID LEVEL INDICATOR, operated directly by the boiler water itself, by the pressure differential between a constant head and the varying head in the boiler drum. Indicating mechanism is never under pressure—no stuffing boxes. See Bulletin WG-1822.

YARWAY HI-LO-GRAPH RECORDER provides not only instant indication but also 24-hour recording of boiler water levels. See Bulletin WG-1830.

ANYWHERE IN THE PLANT

YARWAY REMOTE HI-LO ALARM SIGNALS, lights or horns. Operated by Control Unit attached to Remote Liquid Level Indicator or Recorder. Any number can be installed, at any desired locations throughout the plant. See Bulletin WG-1822.



STEAM PLANT EQUIPMENT

R/M no. 303
a high-temperature valve stem packing

R/M No. 303 is specifically designed for use on valve stems and in expansion joints handling superheated steam or hot gases at temperatures up to 900°F. The core is of large graphite particles which are not affected by heat, but which provide the necessary compressibility. A jacket of pure asbestos yarns, reinforced with Monel wire, is braided over the core and treated with a high-temperature, non-fluid type of binder. The outer surface is finished with flake graphite.

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

Raybestos-Manhattan, Inc. 1-40
Packing Division, Manheim, Pa.
Gentlemen: Please send me data on R/M No. 303.

Name _____

Position _____

Company _____

Address _____

City _____ Zone ____ State _____

R/M

F-H Airslide conveyor collecting Portland cement from storage bins

Screw conveyor replaced by F-H Airslide

AIRSLIDE means "AIR-BORNE"

For sheer simplicity, low-maintenance costs and ease of operation, the F-H Airslide conveyor is just about tops! In this system, dry pulverized materials like cement, lime, gypsum, soda ash, flour or similar products are aerated or fluidized and made to flow like water. Air is dispersed through the material from a porous medium so that each particle is enveloped in air, thus reducing the inter-particle friction and the angle of repose. Hence the material flows.

Think what this means to you? Because the system is completely enclosed, danger of contamination is removed. Dusting is eliminated. The only power required is low-pressure air in small quantities. There are no repairs, replacements or costly down-time. Easily erected and definitely a space-saver, the F-H Airslide conveyor permits a flexibility of plant design not available with straight-line conveyors.

Why not let our engineers show you how the F-H Airslide can help cut your conveying costs . . . modernize your present plant equipment or plan an entirely new system. Chances are we can show you how a minimum expenditure can bring you a conveyor system that means low cost, reliable operation.

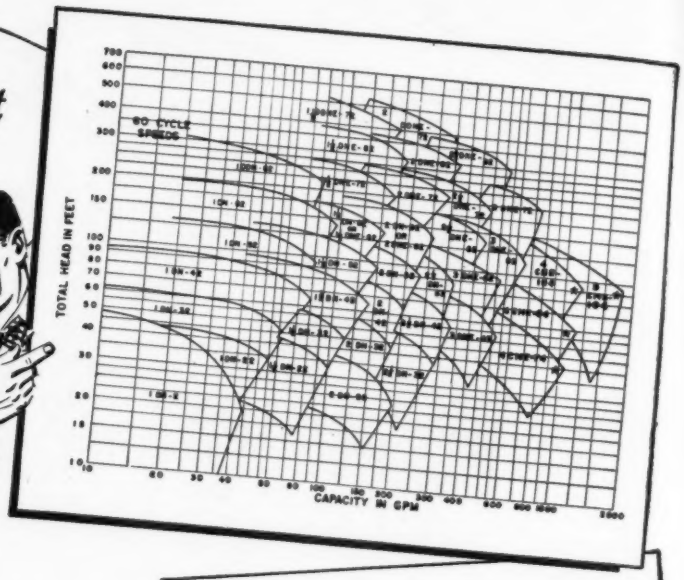
FULLER COMPANY, Catasauqua, Pa. • 120 S. LaSalle St., Chicago 3 • 420 Chancery Bldg., San Francisco 4

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS—COMPRESSORS AND VACUUM PUMPS — FEEDERS AND ASSOCIATED EQUIPMENT

fuller

FH-14

Whatever You Want in a General Utility Pump ...Here It Is!



OVER 10,000 STANDARD COMBINATIONS WITH WORTHINGTON CN AND DN CENTRIFUGALS!

The modern answer to today's small pump problems—Worthington CN and DN Pumps offer a breadth of coverage and a choice of style that will suit your requirements to a T. Hydraulically, both types are identical. Their liquid ends, of the same highly efficient, up-to-the-minute design, are interchangeable, and can be equipped with either conventional packing or mechanical seal.

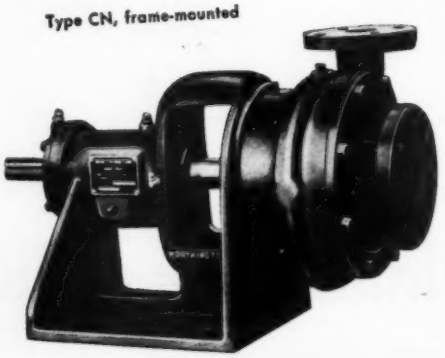
Type CN, frame-mounted, is a real "any-drive" pump — readily driven by an electric motor, V-belt, or any other mechanical power-source. Type DN is the famous Worthington Monobloc design — compact, streamlined, with built-in motor.

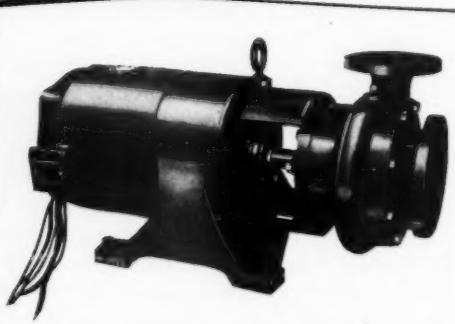
This Is Real Coverage

With the CN and DN you have 40 sizes of pump-casings to choose from, with capacities from 10 to 1750 gpm and heads from 20 to 500 ft., as shown on the above chart. There are 200 combinations of frame-mounted designs and, considering both type pumps, over 10,000 standard combinations! Despite this wide range — the CN and DN pumps are designed to have maximum interchangeability of component parts.

From this vast selection you're sure to find the combination that will meet your pumping needs. That means the end of compromising with pumps that are not just right for *you* — and the beginning of the money-saving performance that proves *there's more worth in Worthington*. For details, call on your Worthington distributor, your "Local Good Right Hand of Industry", or write to *Worthington Pump and Machinery Corporation, Pump and Compressor Merchandising Division, Harrison, New Jersey.*

Type CN, frame-mounted





Type DN, Monobloc

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
PUMP AND COMPRESSOR MERCHANDISING DIVISION
HARRISON, NEW JERSEY

The Good Right Hand of Industry

POWER TRANSMISSION:
sheaves, V-belts, variable speed drives
PUMPS:
centrifugal, power, rotary, steam
AIR COMPRESSORS:
water-cooled, air-cooled

PC-54

INDUSTRIAL POWER

April, 1950 Vol. 58, No. 4

INDUSTRY AND POWER'S NEW EDITORS

WE take pleasure in introducing two new members of INDUSTRY AND POWER'S editorial staff: William J. Hargest, editor, and Eugene W. F. Feller, managing editor.

Wm. J. Hargest

Bill Hargest was selected for editor because of his engineering training and previous editorial experience. This work, which well qualifies him to guide editorial policies of INDUSTRY AND POWER, began in 1916 as apprentice on the Pennsylvania Railroad. In 1922, when he was a machinist and Federal locomotive inspector, he entered Penn State. Graduating in 1926, he served three years as locomotive and car designer, test engineer and locomotive shop superintendent.

It was in 1929 that he entered the editorial field as associate editor of *Railway Mechanical Engineer*. During the depression, he remained a contributing editor on that paper, and was on the staff at Pratt Institute teaching mechanical engineering. This school is still using the manuals he wrote on concrete design and construction, power plant design and operation, combustion, and strength of materials. During his four years at Pratt Institute, and for two more years on the editorial staff of *Railway Mechanical Engineer*, he edited articles for *Mechanical Engineering, ASME Transactions*, and *Journal of Applied Mechanics*. He also edited the 1936 ASME Boiler Code.

American Machinist secured Bill's services in 1938, and as associate editor he wrote and illustrated many authoritative articles in the iron and steel, metal-working, automotive, aircraft, plastics and power-equipment fields.

During the war, he was a war correspondent in Europe, covering stories on British war production as well as operation and maintenance of military mechanized equipment at rear echelons and the front. Later, he surveyed the effect of strategic bombing of war plants in Germany, and studied production of flying bombs and rockets in German underground factories. Following cessation of hostilities, Bill remained in Britain as editor and business manager of *The Machinist*. In 1947, he returned to this country, and served two years as editor of *American Exporter Industrial*.

Bill is a member of The American Society of Mechanical Engineers, Institution of Production Engineers (London), and Ingenieurs Civils de France. In 1946, he participated in organizing the World Engineering Congress, and is a charter member. He has served on many ASME committees, including that society's War Production Panel, and the Oil and Gas Power, Metals Engineering, and Railroad Divisions.

Eugene W. F. Feller

Eugene W. F. Feller was formerly associate editor of Power and managing editor of Operating Engineer. Gene's conscientious efforts were a real contribution to the notable reader acceptance that Operating Engineer earned under his management.

From a biographical sketch in the June, 1949, supplement to "International Who's Who," he is a graduate of Coyne National Trade School, the ICS courses in steam and electrical engineering, and industrial safety at Johns Hopkins University.

Gene is an outstanding practical engineer who came up from two years as machinist helper in railroad shops through 22 years engineering and supervision experience in steam and hydroelectric plants, including installation, maintenance, operation, training and supervision.

He was assistant chief operator of the Safe Harbor plant of Safe Harbor Water Power Corp. He compiled instructions and trained the operating and maintenance personnel when the plant was put into operation.

After entering editorial work, Gene authored two books in the power field: "Air Compressors" and "Instrument and Control Manual for Operating Engineers." He has been active in the affairs of engineering societies, including the National Association of Power Engineers, National Association of Corrosion Engineers, Instrument Society of American, and the National Association of Refrigeration Engineers.

With his broad knowledge of fundamentals and operating experience, plus his editorial background, Gene is especially qualified to serve the readers of INDUSTRY AND POWER.

C. LESTER SEAMAN, President

BENZOL'S NEW BOILER PRODUCES STEAM AT "HALF THE COST"

Installation of a new 40,000 lb per hr oil-fired boiler at the Benzol Products Company proves that the investment in modern steam generating facilities is a "gilt-edged" security, that a reduction in steam costs means greater over-all profits. A by-pass that recirculates preheated combustion air prevents condensation, eliminating plugging in the air tubes and clean-out doors, and cleaning is permitted without waiting for shutdown period

J. B. ZIMMERMAN, Plant Manager, and
F. C. VENEZIO, Plant Engineer, Benzol Products Co., Piscataway, N. J.

SINCE the war, industry has placed so much emphasis on economy that in many plants the opportunities for further reduction of over-all operating costs are becoming "few and far between". This was the situation at the Benzol Products Company of Piscataway, N. J., manufacturers of basic medicinal chemicals. However, as the result of the recent boiler installation at the Benzol plant, the cost of generating processing and heating steam has been slashed 50%, from 90 cents to 45 cents per 1000 lb. The boiler modernization program not only reduced the cost of boiler plant operation, but it has effected greater economies in the production departments as well. With the assurance of a dependable steam supply—at stabilized pressures and temperatures—these departments function at top efficiency.

The new boiler is an oil-fired, 2 drum, water tube type, capable of producing 40,000 lb of steam per hour at 100 psi continuously and 45,000 lb per hr for two hour periods. Efficiency is approximately 87%. CO_2 readings have averaged around 12% and stack temperature is 300° F. The boiler is completely water-cooled, with tubes on all four sides, top, and floor.

Since the steam generating facilities are often considered the "heart" of a chemical plant—many processes depend on the maintenance of pressures and temperatures within rather narrow limits and for comparatively long periods of time—extreme care was taken in selecting the boiler. The unit had to be able to handle a wide range of variable loads and be capable of maintaining a high availability factor.

Although basically the boiler selected was capable of meeting the conditions as a result of its efficient water circulation, several modifications, which make this installation unique in several respects, were incorporated into its design. One feature is the method of handling the forced draft.

The FD fan is located on the floor at the rear of the boiler. This unit is motor driven at 1800 rpm and is designed

Left—Firing level of the boiler is approximately 3 ft above normal floor line. The operator is adjusting the fuel-oil atomizer

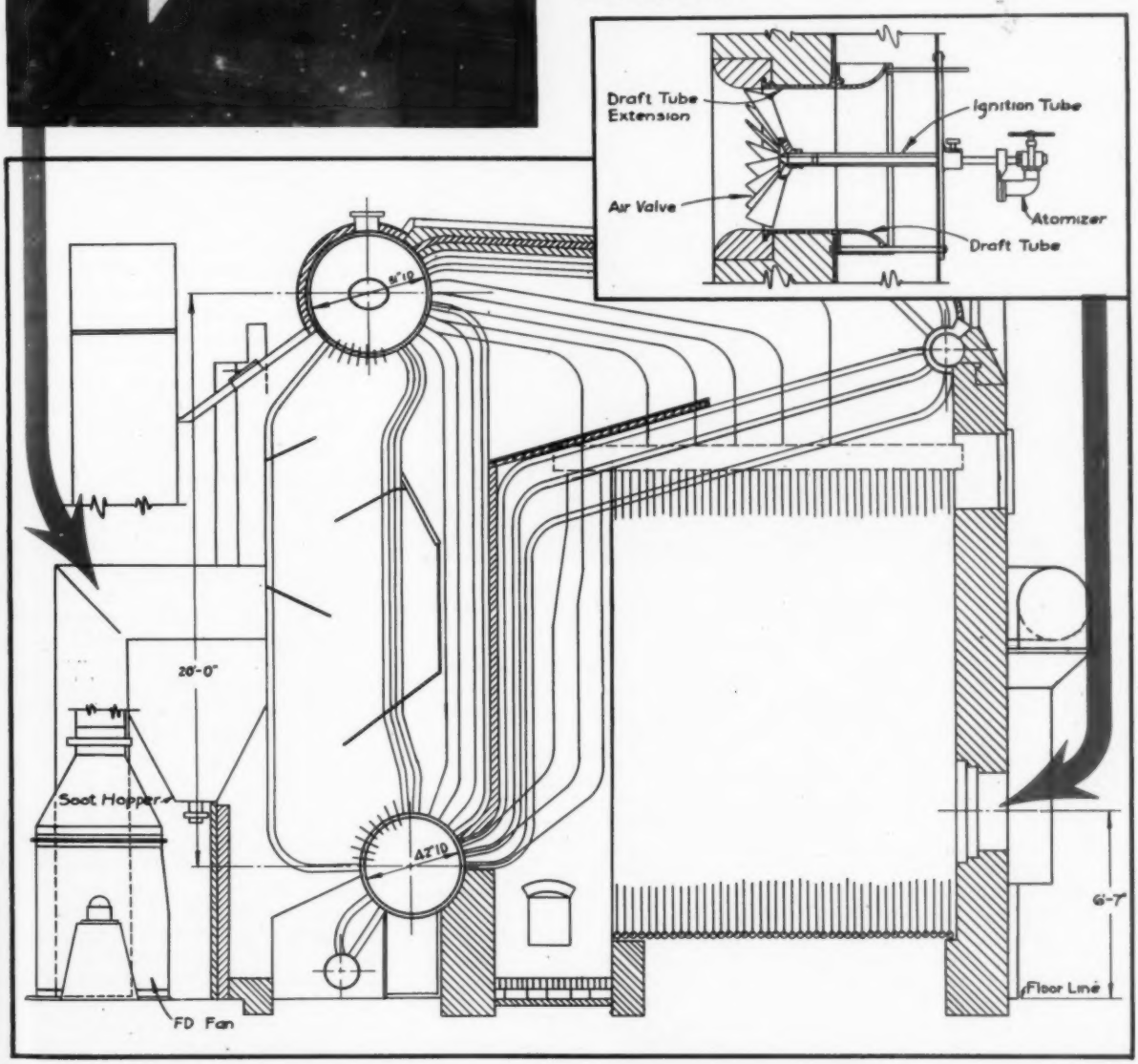
Right—FD fan can handle 39,800 lb of air per hour. Suction of the fan picks up room and by-pass air, tempering air mixture

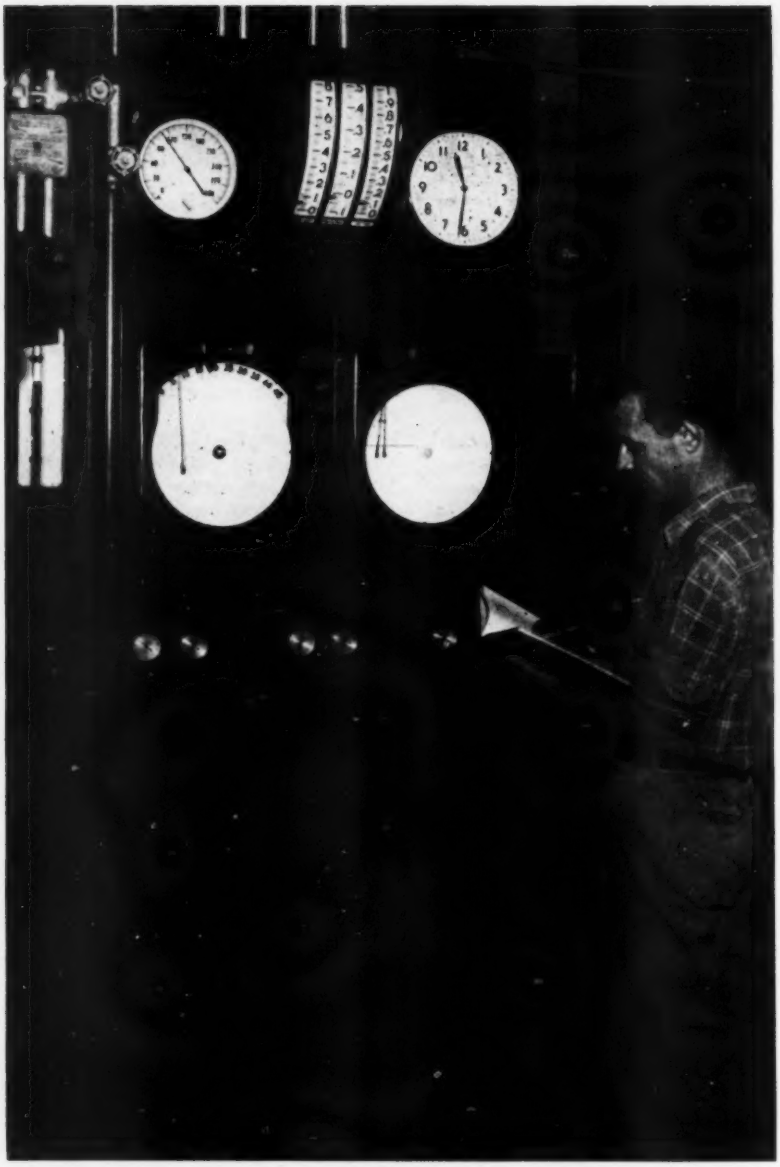
Left—A portion of the combustion air from the pre-heater is by-passed in this 18-in. duct to the FD fan inlet. This reduces condensation in the air-heater tubes

Below—The 40,000 lb per hour boiler is fired with oil burners that have a new type of air register with fixed stainless steel baffles. Detail of burner is shown in the inset sketch

to handle 39,800 lb of air per hour at room temperature. Rather than have the fan take all of its air directly from the room, a by-pass duct was installed to recirculate a portion of the combustion air from a point where it leaves the preheater to the fan inlet. Discharge end of the 18 in. diameter by-pass duct was placed several inches away from the fan's suction screen. Thus heated air from the duct supplements and tempers the incoming air to the fan. A marked improvement in the elimination of condensation in the air heater tubes has been noted, which permits a longer run at lower stack temperature.

Another improvement, although minor in scope and one which has no direct bearing on the boiler operation, is the installation of cleanout doors in the top of the combustion air preheater. Except for these cleanout doors, the preheater is of conventional design





Boiler operation is automatic, the control board being located next to the boiler front. The controls are air-actuated by compressor behind the panel

and is located at the rear of the boiler. The unit is a two-pass type and contains more than 400—2½ in. diameter tubes for conveying the flue gases. Incidentally, the heater was designed for 30% excess capacity.

Because of ample headroom above the boiler, the installation of clean-out doors in the top of the heater was feasible. This arrangement offers several advantages: (1) easy access to all tubes enables the maintenance man to do a good job on the entire heater; (2) tubes can be brushed clean only several hours after the boiler is taken off of the line; and (3) cleaning operations can be scheduled on a regular basis since the need for waiting for prolonged boiler shut-downs is eliminated. At the present time the heater is cleaned once a month and the condition of the tubes remains "like new".

The induced draft fan, motor driven at 900 rpm and designed for 44,000 lb of air leaving the preheater per hour, is also installed at floor level at the rear of the boiler. The breeching extends through the building wall and connects to the existing steel stack that served the old boiler plant. To reduce condensation and corrosion of the metal, the exposed duct is insulated with 2 in. thick fiberglass batts and covered with a heavy coating of weather-proof cement.

The new boiler is equipped with two forced draft steam atomizing oil burners. The burner units have newly developed air registers with fixed stainless steel vanes or baffles. The fixed vanes permit a wide range in operation without changing the air turbulance over the entire load range and reduces the roaring combustion noises. Combustion air is regulated by a cylindrical bustion air is regulated by a damper controlled from the front of the burner.

Monel-Tip Burners Used

Several different types of burner tips were tried when the boiler was first placed in operation. Most efficient operation under the given conditions of this installation was noted with a blunt-nosed monel tip with 105° flare angle.

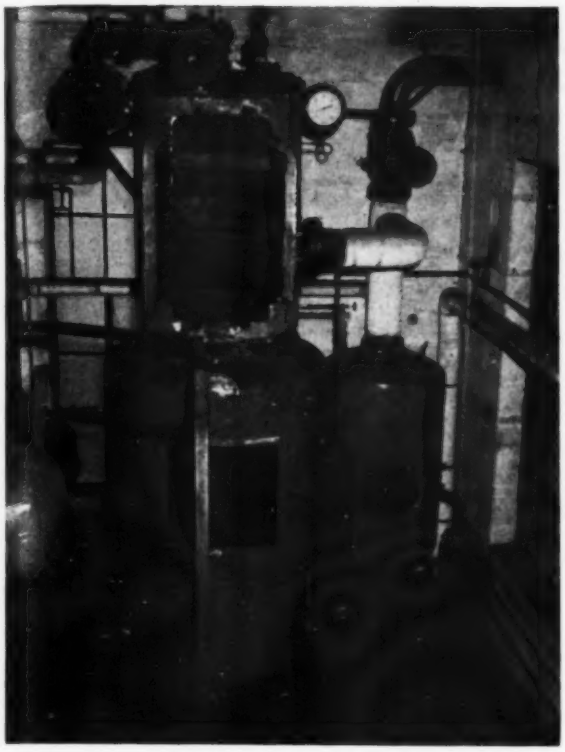
No. 2 fuel oil is utilized for starting from a cold start. Similarly, compressed air is employed for atomizing until the steam pressure is up. As soon as the boiler is "warmed up" the fuel supply is switched to Bunker C oil and steam is used for atomizing. Under full load less than 1% of the steam production is required for atomization.

Bunker C fuel oil is stored in two 23,000 gal underground tanks located just outside of the boiler room. Fuel is received either by truck or tank car. The oil is heated to 90-100° F at the tank outlets and passed through a duplex strainer before entering the fuel pumps. A steam-operated reciprocating pump handles the oil in regular operation but a motor-driven centrifugal pump is installed as a stand-by. Before being delivered to the burners, the oil is passed through a second preheater which raises the temperature to 180° F. This heater is equipped with an automatic temperature control.

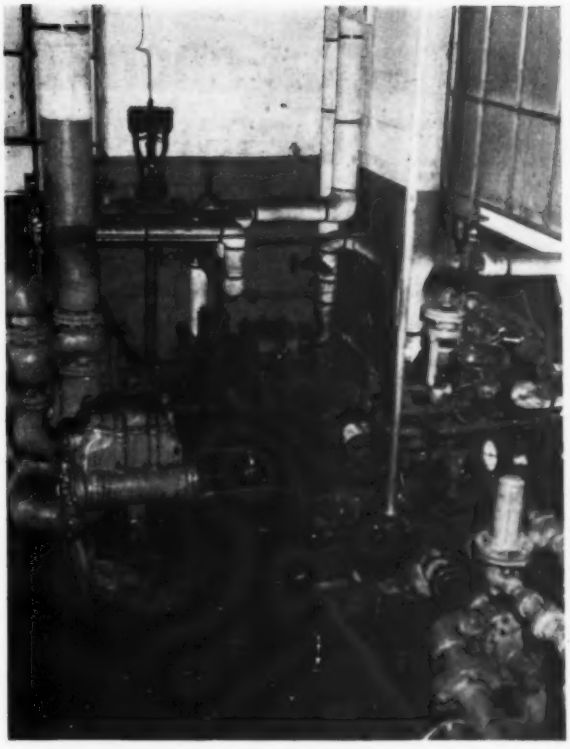
Feedwater Make-up 75%

Since most of the steam generated is consumed in the production departments or becomes contaminated in the processes, the boiler feedwater make-up averages around 75%. The feedwater is handled by two reciprocating steam pumps, one a standby, which operates at boiler pressure. The pumps are equipped with automatic lubricators; however, the lubricant is injected into the steam supply line to the pumps ahead of the regulating valve to insure efficient internal lubrication.

Feedwater is heated in a tray type deaerator which operates on 3 to 4 lb steam pressure. Water enters the boiler at 223° F. An additional safety feature has been installed on the deaerator in the form of a 4 in. pipe loop some 18 to 20 ft long. Water contained in this loop maintains a 7 or 8 lb back pressure on the deaerator tank and should the unit's safety valve fail to function in an emergency, the loop will serve as a vent.



Tray type deaerator, operating on 3 to 4 lb steam pressure. Feedwater is supplied to boiler at 225° F



Two-steam-driven reciprocating pumps circulate the feedwater. One of the pumps acts as a standby unit

Caustic and phosphate are added to the feedwater in regulated batches at timed intervals. A small amount of sulphite is also added. The treatment is injected into the system on the suction side of the feedwater pumps. Boiler water samples are checked once each shift. Although the boiler is equipped with an automatic continuous blowdown device, valves are also provided for manual blowdown.

Boiler operation is completely automatic, the control board being conveniently located next to the boiler front. Controls are air-actuated by a small compressor installed directly behind the panelboard.

The Benzol installation is an excellent example of what modern steam generating equipment can do for a small industrial boiler plant. The new boiler replaces two Scotch marine units, rated at approximately 200 hp each, manufactured more than 30 years ago.

Although the old boilers were stoker-fired, their efficiency was so low that the production of steam was almost a luxury. Furthermore, their condition was such that to keep the units in good repair was difficult; in fact, it was practically impossible.

LIST OF PRINCIPAL EQUIPMENT

Boiler—Riley Stoker Corp.
Oil Burners and Pumps—The Engineer Co.
Draft fans—Clarage Fan Co.
Draft fan motors—Westinghouse Electric & Manufacturing Corp.
Fuel pumps—Warren Steam Pump Co. and Kinney Manufacturing Co.
Oil preheater—The Whitlock Mfg. Co.
Automatic control on oil preheater—Atlas Valve Co.
Feedwater pumps—Worthington Pump & Machinery Co.
Lubricators—Manzel, Inc.
Deaerating heating—The Swartwout Co.
Safety valves—Manning, Maxwell & Moore, Inc.
Valves—The William Powell Co.
Continuous blowdown—Strong Carlisle & Hammond Co.
Soot blowers—Diamond Power Specialties Corp.
Automatic controls—Hagan Corp.
Steam flow meter—Cochrane Corp.
Draft gages—The Hays Corp.
Water column—Reliance Gauge Column Co.
Compressor—Ingersoll-Rand
Feedwater treatment—Hall Laboratories

Two-pass preheater contains four hundred 2½ in. tubes and was built for operation at 30% excess capacity. Ample room around the preheater, and use of clean-out doors, permit cleaning operations on a regular schedule without prolonged boiler shut-downs

FACTORS IN GROUNDING SPECIFIC EQUIPMENT

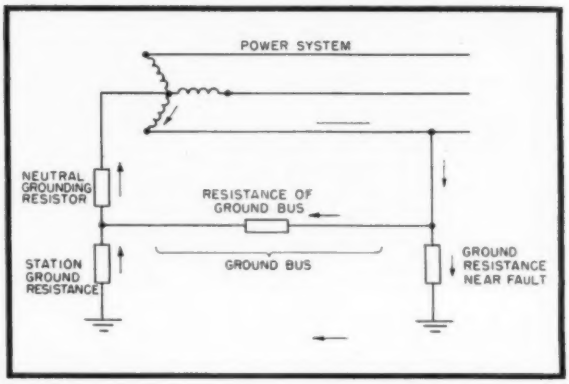
The third and last article in a series on neutral grounding of industrial power system is composed of highly practical and useful application rules, well illustrated by easily understood diagrams

W. F. STRONG, Industrial Power Division, General Electric Company

Resistance of the ground path from the power system neutral should be as low as possible

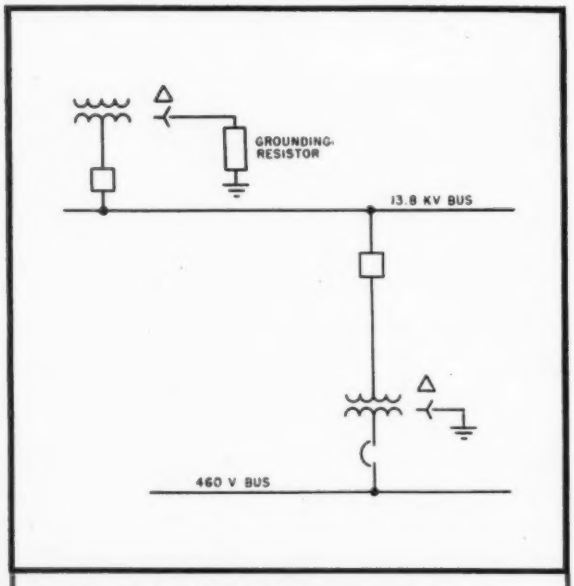
CONNECTION from station ground to frames and enclosures of apparatus: When the neutral of a power system is grounded, the resistance of the ground return path from the various apparatus back to the neutral grounding point should be as low as possible. Such paths generally consist of the building framework, conduits, cable sheaths, and copper ground conductors. In most cases low resistance in the described network (which can be called the plant ground bus) is more important than a low resistance

(Text continued on page 78)



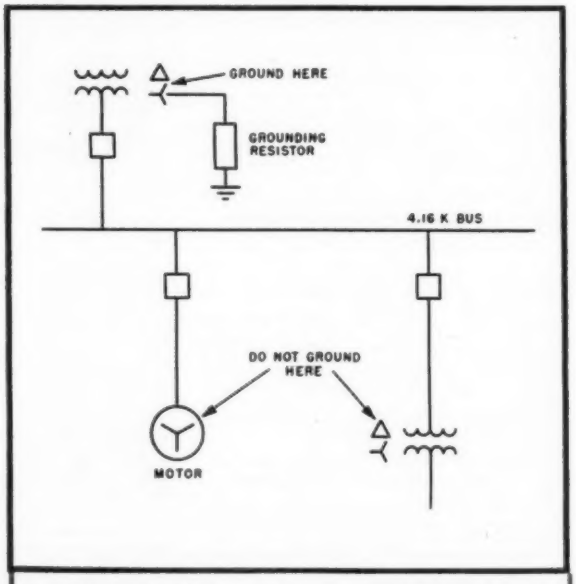
APPLICATION RULES

The following illustrations cover some of the important factors to be considered in particular system grounding problems



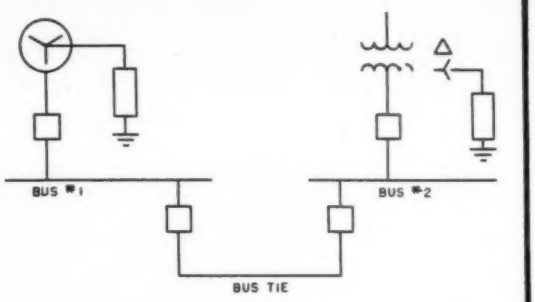
1—Ground at Each Voltage Level

Transformers insulate the 13.8 circuit from the 460 v circuit. Grounding one voltage level does not ground the other. Treat each level separately and ground



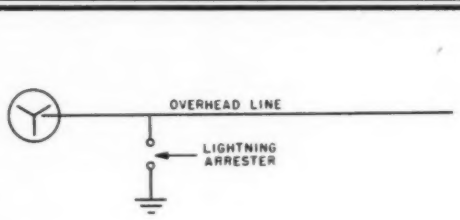
2—Ground at Power Source and Not at Load

Grounding of several loads may mean excessive ground-fault current and complicated relaying for selectivity. When not wye-connected, use grounding transformer



3—Ground Each Major Bus Section

Bus tie circuit may be open, thus leaving one bus and its circuits ungrounded if only the other is grounded.



6—Lightning Arresters

(a) Use grounded neutral type on system grounded solidly when ground-fault is at least 60% of three-phase current
(b) Use ungrounded neutral type for resistance, resonant, and reactance-ground systems when ground-fault is less than 60% of three-phase current

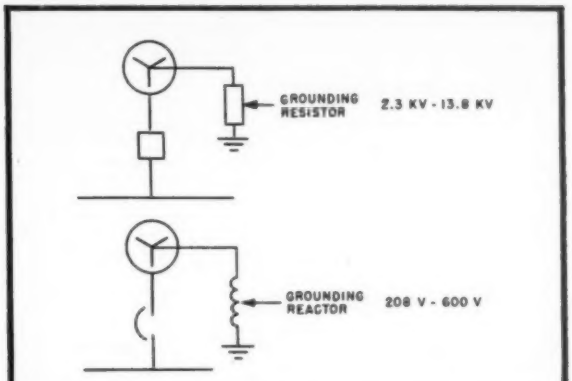
TABLE V

Minimum Ratings of Generators and Transformer Banks for Grounding

System Short Circuit Kva	Minimum Kva Rating
1,000,000	7500
500,000	3750
250,000	1750
150,000	1000
100,000	750
50,000	375
25,000	187

4—Generator or Transformer Size Used for Grounding

Grounding apparatus should have a kva rating equal to or greater than that shown in Table V. The use of smaller rated apparatus might permit development of excessive transient voltage

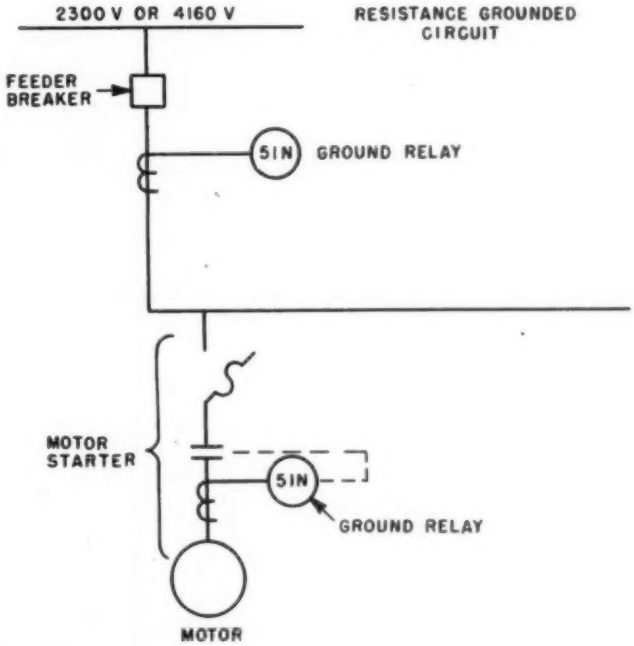


5—Do Not Ground Neutrals Solidly

Use resistance grounding on medium voltage systems, reactance grounding on low voltage systems. If grounded solidly, ground-fault may exceed three-phase fault-current and the value for which the generator winding is braced.

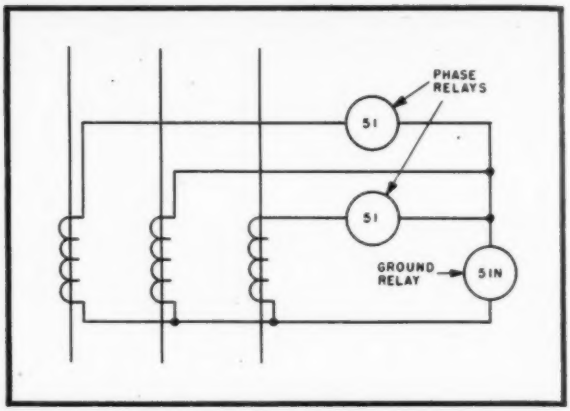
7—Fused Motor Starters at 2300 and 4160 Volts

Fuse alone will not provide adequate protection for ground-faults in resistance grounded systems
(a) If ground-fault current is under interrupting rating of motor starting contactor, add a third CT and residual relay to open a contactor for ground-fault in the motor
(b) Use a residual relay on circuit breaker feeding one or more fused motor starters as ground-fault protection for the group as a whole. Scheme (a) is more selective



8—Three Current Transformers Required per Circuit

Many existing systems—2.3 to 13.8 kv class—may have only two CT's per circuit and two-phase relays. Neutral-grounded systems must have ground relays and a third CT added on each circuit. In a low voltage system direct-tripping circuit breakers must have one tripping device per pole. Fused circuits must have one fuse per phase. All switchgear equipment within the last ten years has three CT's per circuit above 600 v, and three trip coils per circuit breaker at 600 v and below. Hence, no additional CT's or trips are required on this equipment. In motor control, standard low voltage combination starters are suitable for grounded-neutral systems. More than two overload heaters per starter are not necessary, they protect for motor overloads rather than short circuits

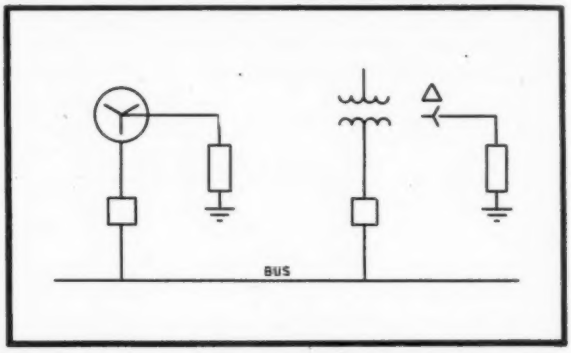


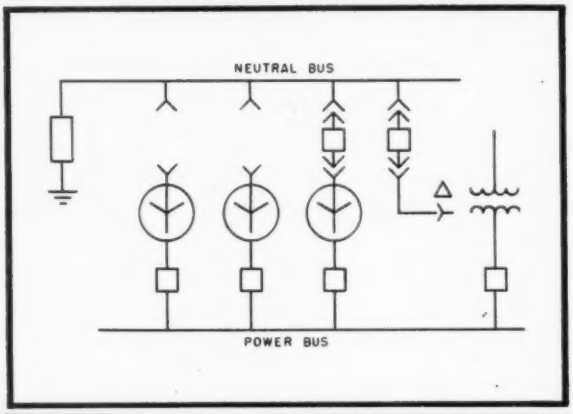
9—(a) Multiple Power Sources

Individual neutral resistors or buses and switchgear.

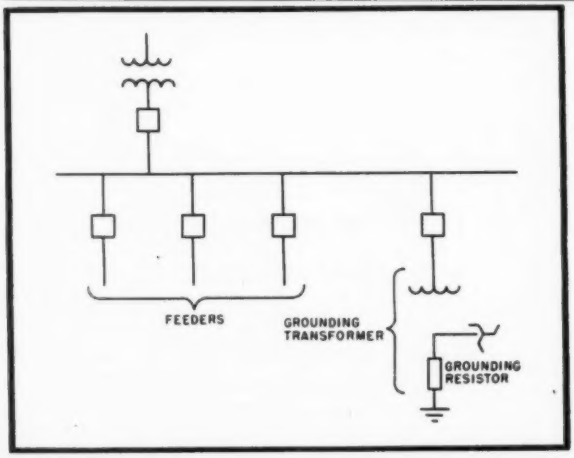
(b) Two or Three Sources In A Medium Voltage Bus System

Permanently connected grounding resistors for each machine. Resistors identical, selected so one machine and resistor provides sufficient ground-fault relaying current





10—A bus having four or more power sources: use a neutral bus, one resistor and one breaker. Operate with one neutral circuit breaker



11—Grounding Transformer

Use a grounding transformer when it is necessary to establish the systems neutral

between this bus and the earth itself, Fig. 9.

Advantages of low ground return resistance are:

(1) Safety to personnel. High resistance may mean a relatively high voltage between the frame of a motor, for example, and some point on which the operator is standing when a ground fault occurs in the motor.

(2) Positive interruption of fault currents. High ground resistance may limit the ground fault current to values below which circuit breakers and fuses operate.

Accompanying bibliography provides references covering ground buses and measurement of ground resistance.

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PROPER COAL USAGE CONFORMS TO AIR POLLUTION ORDINANCES

Public demand for abatement of air pollution nuisances is increasing. This authority explains firing methods that will produce good combustion and reduce air pollution

WILLIAM S. MAJOR,
Development Engineer, Bituminous Coal Research, Inc.

PUBLIC demand for abatement of air pollution is increasing, and more attention must be given to ways and means of assuring low smoke density and dust in exhaust gases. Three principal fuels—coal, gas and oil—can be burned to yield acceptable stack discharge if the burning characteristics of the fuels are given proper recognition.

Current designs of coal-fired steam generators can be provided with adequate grate area and a boiler configuration for properly using the fuels that will be economically available during the life of the equipment. There are, however, some older installations that do not digest the fuels for acceptable atmospheric discharge. Auxiliary equipment, such as overfire jets, cinder traps, or dust collectors, can frequently do much in older plants to offset limitations of furnace design and promote better stack conditions.

Legal attempts to reduce air pollution are not new. As early as 1306 a Royal proclamation was issued for bidding coal in London because of "unwholesome vapors". Heavy fines were imposed and repeated violation resulted in destruction of the furnace. St. Louis passed an ordinance in 1867 limiting stack height of any steam saw or planing mill, factory, or foundry to not less than 20 ft above the adjoining buildings. The St. Louis regulation did not restrict dense smoke but required the smoke to be dispersed in the atmosphere above the buildings. Ordinances declaring the emission of dense smoke a public nuisance were adopted by Chicago in 1881, Cleveland in 1892, and Minneapolis in 1894. From these earlier ordinances more comprehensive codes were developed to limit the permissible time for dense smoke and restrict the amount of solids that may be discharged to the atmosphere. Men who really understand the magnitude of the problem are convinced, however, that smoke is a very small contributing factor to air pollution. Such factors as topography of the country, prevailing winds, wind velocity, and temperature inversion conditions are extremely important in air pollution even with stack emission kept to a minimum. Dust, rubber, fabrics, seeds, and pollen are some of the other contributors to air pollution. This article, however, will be confined to the proper use of coal, with stokers in industrial plants in order that stacks will meet smoke and dust emission regulations.

Regulations

All ordinaces prohibit dense smoke. Approximately 75% specify the Ringelmann scale as the basis for measuring density. Ringelmann No. 2 or No 3 is at present defined as dense smoke, prohibited except for short periods when cleaning fireboxes or building a new fire. The usual tolerance is six minutes in a period of one hour.

Specific limits upon emission of fly ash are prescribed in 17 cities; in other cases the limitation is expressed under a "nuisance" clause. Specific limits, expressed on a common basis for comparative purposes, range between .85 to 2.5 lb of dust or fly ash per 1000 lb of gas adjusted to 12% CO_2 content. These figures are equivalent to .25 to .75 grains per cu ft of gas at a temperature of 500° F. Limitations closer to the lower figures are incorporated in new or revised ordinances.

Causes

Hydrocarbon vapors, when heated to high temperatures with insufficient oxygen to burn them, decompose to finely divided carbon or soot in the form of smoke. Four factors conductive to smoke formation are: (1) insufficient excess air or overfire air, (2) excess agitation of the fuel bed, (3) volative matter distilled too fast, and (4) too small or too cold furnace.

Fly ash cinder are particles of ash and unburned fuel carried in the products of combustion. The method of burning fuel, fuel characteristics, and the configuration of boiler and furnace are important factors in contributing to both quantity and size of the particles in the exit gas stream.

Designing

Much can be done in designing steam generators to incorporate operating characteristics of low smoke and dust in the exhaust gases. A careful study of fuel characteristics, load conditions, configuration of the boiler, types of firing, and grate area is necessary. Sufficient furnace watercooling should be installed to reduce the temperature of gases and entrained ash below softening temperatures before the gases enter the boiler. If there is a wide variation in steam output with sustained low load, furnace water cooling should be kept to the minimum if smoke problems due to a cold furnace are to be prevented. Another project might have high sustained load with a low fusion ash coal. In this case

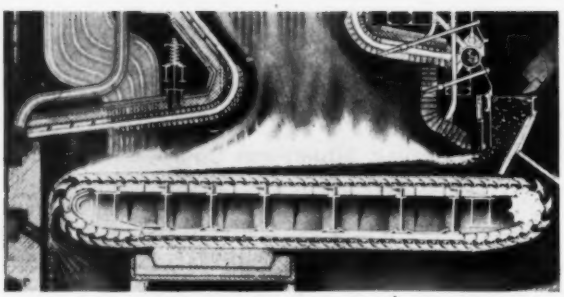


TABLE I—Test Data of Dust Loading Leaving Boiler From Underfeed Stoker Fired Units

Plant	Burning Rates Lbs Coal Per Sq Ft of Grate Per Hour	Grains Per Cu Ft Based on 12% CO_2 and 500°F
A	16	.16
	17	.04
	19	.27
	19	.41
	22	.17
	22	.39
	23	.20
	25	.36
	27	.19
	28	.17
	33	.23
B	31	.034
	31	.046
	39	.078
	39	.138
	39	.073
	39	.118
C	23	.14
	29	.38
	36	.75
	42	1.30

For furnaces with a heat release of 35,000 Btu per cu ft per hour, underfeed and chain-grate stokers can fire coal at 30 to 35 lb per sq ft of grate area per hour and comply with the most stringent dust ordinances

maximum furnace cooling would be advisable in order to keep the furnace temperature sufficiently low for minimum clinker formation and fouling of boiler surfaces by slag.

Underfeed Stokers

In the underfeed type of stoker, coal is forced by mechanical means into a magazine or retort extending into the furnace and is then pushed upwards into the incandescent fuel bed. Air under pressure is forced through the fuel bed. Ash is collected on plates at the side of the retorts or on dump plates at the rear of the furnace and periodically dropped into an ash pit. Alternate designs have a rear grate mechanism for continuously discharging ash or a pit-like structure with crusher rolls for the purpose.

Underfeed stokers are especially adapted for securing smokeless combustion. Furthermore, these units respond rapidly to changes in load, are easy to bank for a time, and handle strong caking coals efficiently. Caking coals, when subjected to high temperature, swell and tend to cake together in a solid mass. The pushing action of the feeding mechanism of the underfeed stoker breaks up the fuel bed and insures combustion.

With this type of stoker a burning rate of approximately 30 lb of coal per sq ft of grate area per hr is practical for continuous duty. At this rate, a furnace with a heat release of about 35,000 Btu per cu ft per hr, smoke and dust emission will usually conform to most stringent ordinances without a cinder trap. For burning rates of about 35 lb of coal a cinder trap or low resistance type of collector should be considered. When the burning rate reaches 40 lb a high resistance type of collector should be installed if the dust emission is to meet more stringent ordinance.

Table 1 shows test data of dust loadings from three representatives well designed and operated boiler units without dust collectors. Plants A and B are burning midwestern coals while plant C burns an eastern coal.

Chain and Traveling-Grate

Chain or traveling grate stokers deposit fuel from suitable hoppers on a grate that moves slowly inward. The coal is first ignited, volatiles driven off, and the fixed carbon is consumed. At the end of grate travel, the ash is dumped into a pit. This method functions well with high-ash, free burning coals. Coals with low-fusing ash perform satisfactorily. Ash from the burned portions tends to settle to the bottom of the fuel bed, where combustion is less active and the temperature is not high enough to melt the ash. When burning coals of pronounced caking tendencies, however, it is not unusual to encounter fuel bed conditions conducive to higher smoke and dust emission. Such coals, as they are carried in the furnace on a traveling grate without agitation, form a solid mass of coke which seriously interfers with uniform air distribution. The air will finally break through in spots and the fuel will burn intensely but unevenly at the rear of the furnace. Sectionalized windboxes for controlling the air pressure along the stoker length are beneficial in maintaining proper air flow and fuel bed conditions.

Incoming fuel is ignited by heat radiated from an arch. The arch and the surrounding furnace construction is designed to provide turbulence for mixing rich gases at the front of the grate with lean gases at the rear. Since designing a furnace that will be equally effective in promoting turbulence over a wide range of steam output is difficult, overfire jets are generally installed to provide supplementary mixing of gases. Some chain grate furnaces have little or no arch construction but rely mainly upon jets to provide the necessary furnace turbulence.

Low smoke density and fly ash are generally realized at burning rates of 35 lb per sq ft per hour when coupled with a furnace that results in a heat release of about 35,000 Btu per cu ft of furnace volume. Sufficient to hold the heat release per hour per sq ft of projected tube area to about 100,000 Btu when burning coals with an ash fusion of 2100° F. Furthermore, the availability of approximately 10% overfire air, at pressures of 10 to 12 in. wg installed in the front and/or rear wall is considered good practice. When burning rates of 40 to 45 lb per sq. ft. are employed, as advocated by some engineers, a high resistance type of collector should be installed to provide compliance with dust ordinances.

A second article by Mr. Major, discussing proper coal usage, will appear in next month's issue.

GRIEVANCES CAN BE AVOIDED

A fresh look at labor-management relationships are discussed by this author to show that company grievances can be caused by numerous plant conditions. Intelligent approach to both employe and management problems is clearly explained

RALPH B. BRYAN, Consultant

"CONDITIONS" is a word rarely employed by management and personnel authorities, but it is a common and potent word in the worker's vocabularly. Furthermore, the expression warrants consideration because the word might block the most sincere effort to achieve good labor relations. Conversely it may foster good labor relations when many other contributing factors are missing.

Circumstances, under which a worker performs his daily duties, are the keystone of labor-management relations, whether or not that fact is recognized by either party. Conditions may be physical, mental, or psychological in nature, and have little to do with such things as contractual relationships, wages, or hours of labor. The worker's attitude may originate in the plant or in personal and family life. But, whatever the nature or origin, "conditions" represent in the aggregate much more than just a personal factor; they constitute a production force of no little consequence.

Importance of such a situation to plant output was never better exemplified than during the great effort of the war years. Employment opportunities were never more plentiful in all the history of American production. High wages were the rule, rather than the exception. Organized labor reached a new zenith of power, and contractual relationships were never more favorable to the worker. Yet, time and again the worker determined the choice of a job by: (1) conveniently timed work shifts (2) availability of good food (3) rest and recreation facilities (4) rest periods (5) music piped to factory work-rooms (6) clean, light, and airy plant (7) adequate bench space (8) intelligently friendly supervision and (9) many other like attractions.

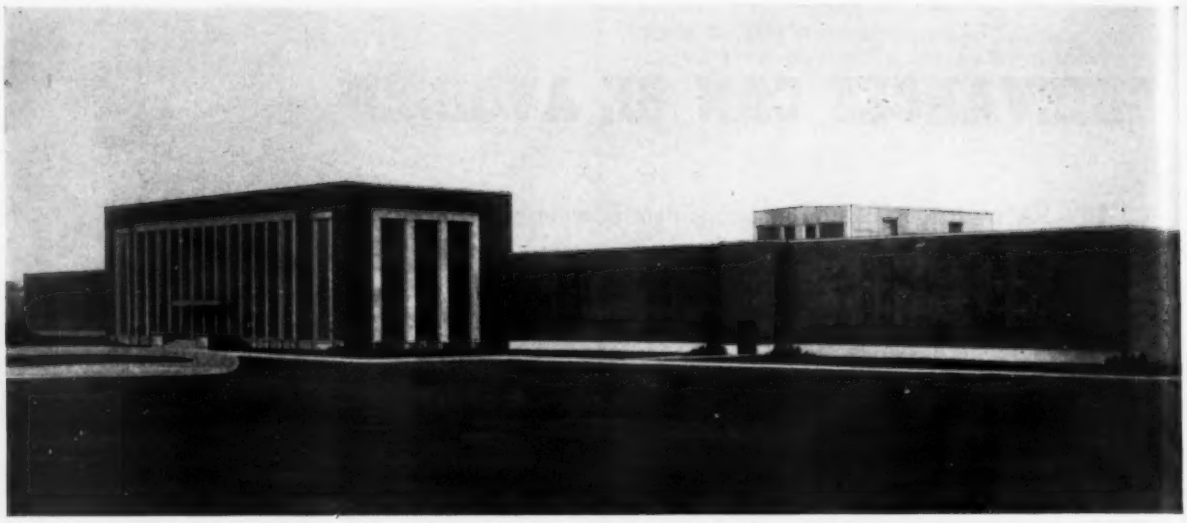
Word soon is spread regarding the plant's reputation, and naturally the workers will seek the best situation every time. In time of great productivity a high caliber working force is essential to high output. In days of lessened production, the same high caliber workers are essential to profitable and efficient output. Production today must be efficient to be profitable. Working environment must be good so as to inspire greatest labor productivity and efficiency.

Management provides—workrooms, machines, tools, benches, and lights for the worker. Physical surroundings are important, and efficiency is often in direct ratio to the physical surroundings under which the employe works. In addition, management is also responsible for mental and psychological disturbances to a great extent. Grievances fade when workers are convinced the boss is with them. A worker will be satisfied if he knows his views will be heard and considered.

Of course, the link between management and worker is the supervisor, who can destroy the best working conditions, or improve the worst. Dissatisfaction is reflected in production reports, cost records, and earning statements.

The supervisor may easily be one

Well-lighted and spacious working areas lend themselves to good personnel attitude. Draftsmen here have high morale—the first step in co-operation



In seeking employment, men would rather work in a new up-to-date plant, such as this, than in an old one. Well kept buildings and planned landscaping increase the employees pride and enthusiasm, which means a satisfied worker

of the firm's most valuable assets or greatest liabilities. For example, a shoe factory foreman kept a baby's nursing bottle in his desk as a "labor management aid". Any time he heard dissention, he offered no comment, but placed the bottle quietly on the worker's bench. The gesture was always good for a general laugh and invariably, the incident was forgotten. The worker's grievance may have been minor, but minor grievances can become major plant disturbances.

Cutbacks Are Costly

Generally when cutbacks and layoffs occur in plants, the problem of handling workers receives less attention. Instead the converse should be followed. A good workman is more than a statistic. Uppermost, he is a human, and neglect will affect his temperament, proficiency, enthusiasm, and loyalty, which are vital to profitable production.

When jobs are scarce the employe many fear a layoff, but other circumstances may affect his usefulness and productivity. The disputes and strikes that grow out of accumulated petty misunderstandings are costly. For example, a company suffered a three-month strike, that cost well over a million dollars because a worker was not properly informed about a new payroll system, and he felt the company had cheated him out of $17.00.

Workers are people, and people are not controlled primarily by reason, judgment, or thought. They are activated and dominated by emotions. Groups of workers form attitudes largely on the basis of personal feelings and prejudices. Management cannot afford to overlook the fact that the basis for most of the friction, discontent, and disputes in a factory results simply from the way workers feel about existing conditions.

Award system, whether the award is of material value or not, brings together management and employe. They soon find each is working for sound relations

Grievance Causes

Grievances spring from any condition or combination of conditions that may make a worker dissatisfied. It may be real; often it is imaginary. In any case, so far as the worker is concerned, the grievance is real and his immediate problem must be handled as such. Workers can express a grievance in one of four ways: (1) verbally, (2) less effective production, (3) self adjustment, and (4) worry and brood silently until the matter becomes an obsession.

Whether the feeling grows into a major grievance, and where it eventually leads, depends largely upon the supervisor. A variety of things can happen depending upon whether the grievance reaches the supervisor, the union representative, other workers,

or the front office. Sometimes such feelings exists for a long time without being made known or being recognized by management. This may be caused by a lack of proper relationship between worker and supervisor, the worker's fear of losing a job by complaining, or a naturally secretive nature. In any case, silence is always a serious threat to good plant relationships and uninterrupted output. The emotions of the worker react upon his thinking, and eventually a feeling turns into grudge, and then into a dispute.

Settlement Techniques

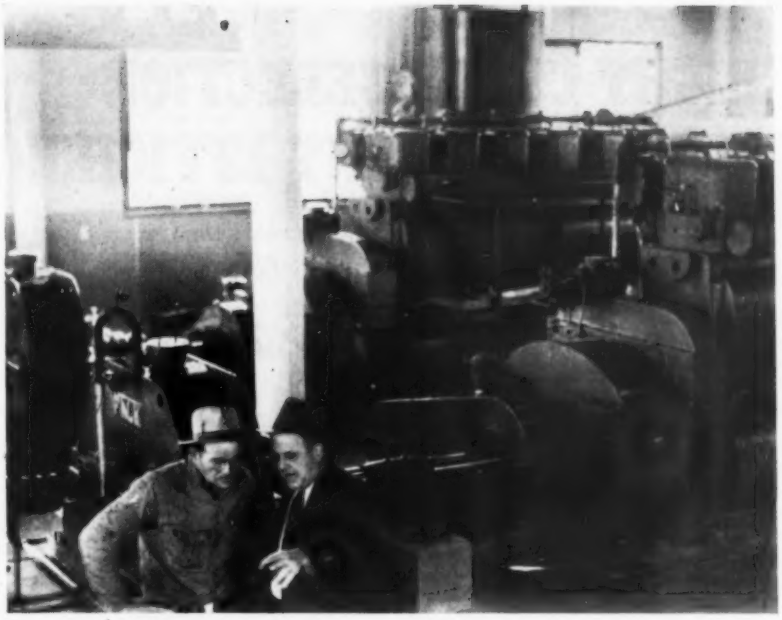
Techniques for handling gripes, do not follow a formulae, but several have been developed by trial and error which may be adapted to meeting individual situations.

(1) Obtain the worker's viewpoint, and be considerate of it, whether the gripe is real or imaginary. The worker is convinced that management is trying to be fair with him and is sincere in the desire to help with his problem

(2) Remain calm and objective. Assist the worker in stating his case, and observe the whole story so the actual root of the trouble can be determined. The "problem-solving approach" keeps the conversation on a basis of friendly discussion

(3) Secure all the facts before attempting any solution. Such procedure prevents accidental unfairness to other employes and also offers the worker a chance to talk himself out of his gripe with no assistance from you

(4) Prevent embarrassment. The complainer must essentially preserve his own self-respect. The worker should never be humiliated, especially before his co-workers, as neither will forget such an occurance



Close co-operation between management and supervisory staff can be fore-runner towards high plant efficiency. The "Veep" on the ball sees his foreman often

(5) Promptness in reaching a decision. This convinces the worker of your interest in his welfare. Caution should be exercised to not make snap judgments and hasty promises that may backfire

(6) Forcing authority to effect a settlement should be avoided. The problem-solving approach of working out a mutual answer instills confidences in the worker as the final decision is partly his own

(7) Avoid referring or passing responsibilities to superiors or other supervisors

(8) Convince the worker of the honest and sincere effort put forth in considering his problem, and assure him the problem will be taken to higher authority if necessary. This attitude protects and improves the relationship.

Indifferent and poor handling of grievances is doubly dangerous. An accumulation of little irritations and aggravations to which no one pays much attention can finally reach a climax.

Management's concern for the safety of employees is one more step leading to harmony, as the employe knows his "boss" is looking out for his welfare

DON'T CLIP—DON'T TEAR

WRITE FOR TEAR SHEETS!

Rather than spoil this issue for other readers in your plant, let us supply you with copies or tear sheets of any of the articles for your files. Just drop a line to the editors — preferably on company letterhead.

RIGHT CYCLE SELECTION IS KEY TO PLANT EFFICIENCY

Efficiency of any industrial power plant is a function of the cycle type employed. Three methods—and influencing factors—that determine cycle arrangement for varying requirements are analyzed in detail by the author. This is the first article of a new series by a qualified engineer and consultant

TYLER G. HICKS, Hicks Associates

CERTAIN general premises may be safely accepted when considering construction of a new power plant or alteration of an existing one. Since the efficiency of any industrial power plant is a function of the cycle type employed, good planning and design require a study of past practice.

For efficiency and economy, steam and electrical loads should coincide throughout the day for an industrial power plant. Of course, when such demands exist the power plant operates at maximum efficiency. Divergence of process steam and power demands does not rule out the privately owned plant; in fact, there are few industrial power plants where the two demands coincide exactly. Only when demands are exactly opposite, or nearly so, can the advisability of private generation be questioned.

Selected Problems

Assume that an industrial power plant generates steam, at 400 psia and 700°F, that is passed through a turbine and exhausts to process at 125 psia. The steam enthalpy at this condition is 1260.0 Btu/lb. With an entering enthalpy of 1362.7 Btu/lb, the heat chargeable to the turbine is (1362.7-1260.0)=102.7 Btu/lb of steam passing through the unit. If the turbine drives a generator, only a portion of the heat is available at the generator terminals in the form of electrical energy. Using a generator efficiency of 94% and turbine mechanical efficiency of 92%, generator output=102.7 (0.94) (0.92)=88.8 Btu/lb of steam. With a boiler efficiency of 78%, the amount of heat supplied the boiler to generate one pound of steam to produce electrical energy is 88.8/0.78=113.8 Btu/lb. Since efficiency=output/input, overall efficiency of the boiler-turbine-generator combination is 88.8(100)/113.8 or about 78.0%.

Now, the turbine heat rate will be 3413/efficiency, or 3413/0.78=4,380 Btu/kwhr at generator terminals. To generate this same power in the usual utility plant would require anywhere from 13,000 to 20,000 Btu/kwhr, according to local conditions. The savings are obvious.

Besides the direct monetary saving resulting from private generation of

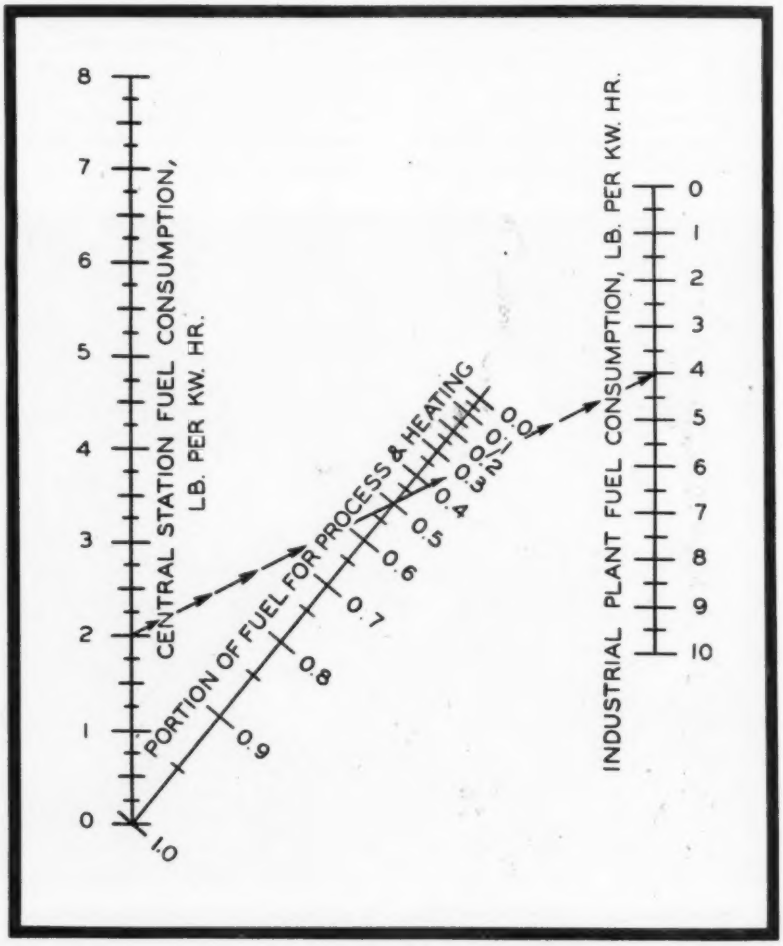


Fig. 1—Chart for obtaining portion of fuel allowable for heating and process in an industrial plant when purchased power is available. To use, connect the central station and industrial plant fuel consumption with a straight line. Intersection with slanting axis locates allowable portion of fuel for heating if consumption in both plants is to be equal

power, a reduction in total amount of fuel consumed by the two plants is apparent. This is an overall saving that is reflected in lower unit fuel costs. A direct ratio of fuel consumption required for heating and process can be obtained from the following:

$$1 - \left(\frac{\text{lb fuel/kwhr, purchased power}}{\text{lb fuel/kwhr, private power}}\right)$$

For example, if a utility burns 1.5 lb/kwhr and an industrial plant 3.0 lb/kwhr, fuel consumption of both plants is equal when $1-(1.5/3.0)=0.5$, or half the industrial plant fuel is required for heating and process. Under these conditions, utilizing less than half the exhaust from a prime mover will produce a loss in the private generating plant and purchased power will be cheaper. Whenever more than half the exhaust is utilized, private generation is more economical. Fig 1 provides easy solution of this relation.

Saturated steam is preferred for industrial heating, drying, evaporation, air conditioning, and similar processes, because of constant temperature heat release obtained with saturated steam. Process temperature can readily be controlled by pressure regulating valves in steam lines conveying saturated steam. The temperature of superheated steam decreases as heat is given up, making it less desirable for most processes where close temperature regulation is necessary. Rapid and extensive development of control and regulating equipment for saturated steam has permitted easy solution of most types of process heating problems. Common practice today is to employ superheat up to about 50°F in process supply lines to insure dry steam at the apparatus.

New Plant Cycles

Cycles for new plants differ in several respects from those in older plants, because present and future requirements are met by installing proper equipment. During planning of many older plants, exact future process requirements could not be foreseen. In other cases, rapid development of steam generating equipment and prime movers were not anticipated or could not be economically allowed for in the design. Hence, specialized means have been developed for caring for such conditions, which will be discussed later.

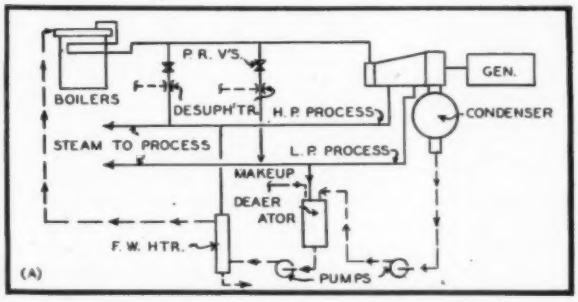
Arrangement for any given industrial plant cycle is determined by (1) electrical requirements, (2) steam requirements, and (3) degree of coincidence between the two demands. Other factors which influence cycle choice are: number of pressure levels required by the process, plant efficiency desired, allowable investment, and type of auxiliary drive most suitable for the industry served.

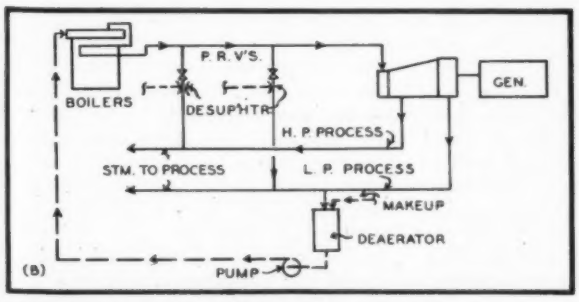
Basically, process demand can be classified as: (a) predominantly electrical, (b) predominantly steam, or (c) approximately balanced demands. Coincidence of demand will be assumed about equal for the time being.

Fig. 2A shows the typical cycle chosen for an industrial plant having large electrical demand and moderate steam demand. One or more extraction type turbines, fitted with condensers, drive generators for production of electrical energy. Steam can be bled from one to six different points of the turbine to supply process needs. Extraction pressure is automatically controlled at the turbine. When process steam requirements exceed the allowable extraction rate for the turbine, pressure-temperature reduction between the high pressure main and process mains can be accomplished. However, since pressure-temperature reduction does not produce useful work, this method should be employed only where absolutely necessary. The condensing and feed heating portion of this cycle is comparable to small central station plants, except process condensate may be returned to open feed water heaters.

When process demand is predominantly steam the cycle shown in Fig 2 B is commonly adopted. Steam, generated at high pressure and temperature (up to about 900 psi and 850°F), is passed through a noncondensing extraction turbine generator. This arrangement is usually satisfactory for industries where electrical demand is small in comparison with steam demand—such as found in some moderate size refineries and certain paper mills. Where electrical demand does not coincide exactly with the steam demand or where electrical demand exceeds the capacity of non-condensing extraction turbine, a condensing extraction type turbine may be included in the cycle.

Two turbines are sometimes employed in plants where steam and electrical loads approximately balance. One is a noncondensing extraction unit and the other a condensing extraction unit. The noncondensing extraction turbine can be arranged to supply both high and low pressure steam for process and the feed water heater, if desired. Both high and low pressure process steam is often supplied by extraction from the condensing unit. Pressure reducing valves and desuperheaters located at strategic





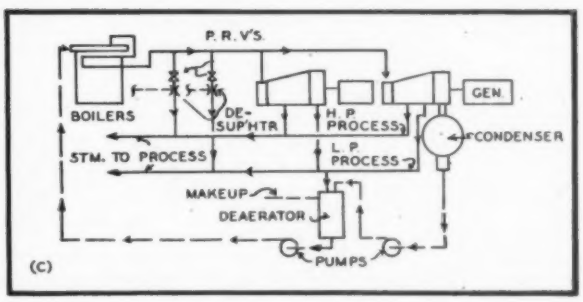


Fig. 2—Typical cycles used for new industrial plants. (A) Demand predominantly electrical; (B) predominantly steam; and (C) about equal demand for steam and for electricity. The cycle diagrams used here are simplified and obviously show only major pieces of plant equipment

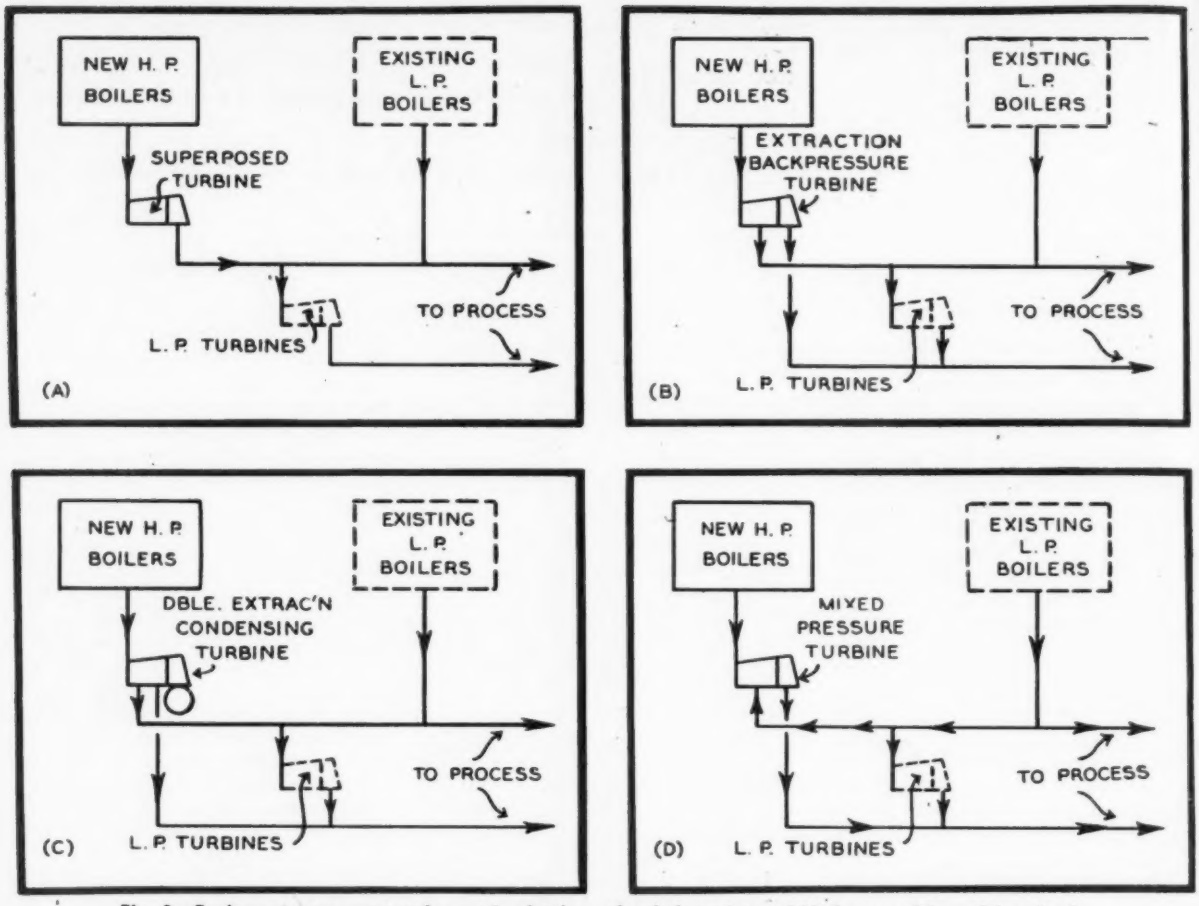


Fig. 3—Equipment arrangement for modernization of existing plants. (A) Superposition with a back-pressure turbine; (B) superposition with an extraction backpressure turbine; (C) an arrangement for divergent steam and electrical demands; and (D) a mixed-pressure turbine which absorbs excess steam

points in the cycle permit adjustment of steam flow to any desired condition. By proper regulation of control devices, steam is automatically shunted to process or turbine, according to the existing electrical load.

As the discussion up to this point has indicated, divergence of steam and electrical demands will usually require two prime movers. The types chosen must produce the desired energy with the greatest economy. Noncondensing extraction turbines are usually indicated for large steam loads and condensing extraction turbines for large electrical loads.

Extraction-Induction Turbines

Extraction-induction turbines can be supplied with excess low pressure process steam in addition to throttle steam or, if desired, low pressure steam can be extracted. These units find application in industries where steam is a by-product of manufacturing, such as certain refining, petrochemical, and automotive plants. The turbines are also installed where exhaust from back-pressure turbines may exceed process requirements during periods of heavy electrical loads.

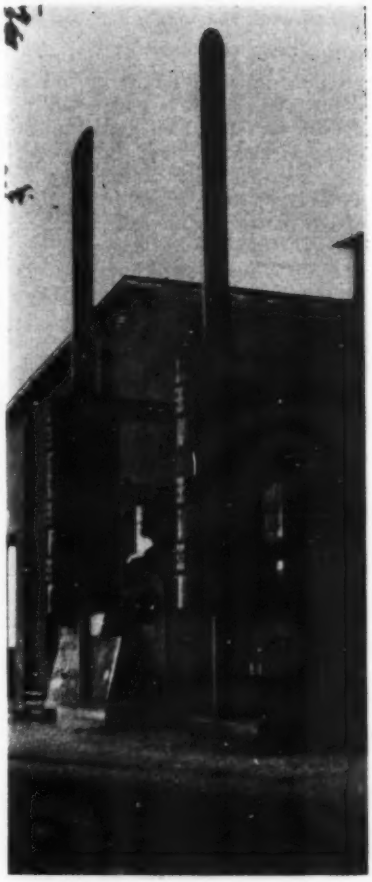
Plant Modernization

Modernization of existing plants is usually accomplished by one of two common methods: (1) use of superposed or topping units, or (2) use of low pressure condensing units. Fig 3 shows typical cycles that have been commonly employed.

Usually the reason for superposition is growth of plant electrical load beyond the capacity of existing units. Under such conditions, two alternatives commonly exist: (a) construction of an entire new power plant, and (b) installation of high pressure boilers and turbines to carry the additional electrical load. The new turbines operate noncondensing, exhausting to the existing units. To date, alternative (b) has proven economical in many cases. Existing units remain in operation, overall plant efficiency closely approaches that of an entirely new plant, superposed heat rate is most satisfactory, and condensing water facilities need not be increased.

Arrangements of various cycles are shown in Fig 3, and in each case of superposition, a new high pressure boiler and turbine is utilized. In a low pressure turbine system a new turbine is installed, and steam is supplied by existing process units or engines. The cycle shown at 3A usually permits substantial savings when applied to industrial plants operating in the 200 psi range, which is rather common for older plants. The cycle at 3B is most useful and economical when some of the existing units are fitted with condensers. A condensing extraction turbine, 3A, is often applied where steam and electrical demands do not coincide exactly.

Of course, the cycles discussed do not include all possible variations. However, the few major types represented have been found successful. As the statements made throughout the discussion have been general, modifications may therefore be necessary when a specific plant is considered in relation to local conditions and demands. Cycle calculations will be discussed in a subsequent article.



FREEBURG CUTS $2,000 OFF ANNUAL FUEL BILL

Changing from steam to dual-fuel Diesels lowered cost of power production for Freeburg, Ill., and increased plant efficiency. How the modernization was accomplished without service interruption is explained in this article

SAVINGS of nearly $20,000 a year on fuel bills for Freeburg, Ill., have resulted from new concepts of power production economy. The introduction of natural gas, now anticipated, will increase fuel savings another $10,000 for these prime movers are dual-fuel engines. The community of 2,000 population, 25 miles southeast of St. Louis, is a coal burning town as nearby coal mines provide a livelihood for a great many of the residents. Since 1903, power and light have been supplied by a succession of steam engines, the latest of which was installed in 1936. But, economic realities can be a powerful force for a change. Furthermore, growing deficits convinced the municipality that the steam plant was a liability, and a more efficient power plant was needed if rates were to be maintained.

Selection of Diesels

Several factors influenced the choice of engines. First, the city wanted to keep capital expenditures down, so the old building was retained to house the new equipment. Second, the old steam plant had to be operated until the new Diesels were on line. A preliminary survey indicated a two-engine plant system was required, because Freeburg engineers found other municipal plants outgrew small engines selected on exact load conditions. For this reason, larger units with good efficiency at partial loads were purchased. Oil was the best available fuel, but provisions were made for eventual change over to natural gas.

Two identical turbocharged, dual-fuel Diesels of 6 cylinders, 12 in. bore and 15 in. stroke, rated at 690 hp at 450 rpm were selected. Each unit is direct connected to a 485 kw, 3-phase, 60-cycle, 2400-volt generator with a 10 kw V-belt exciter. The engines at present burn fuel oil, but the units will be operated on natural gas as soon as the pipe line is completed.

Without disrupting service, the Diesels took over the full load, and the steam operated equipment was dismantled. The first nine full months

Left. Exhaust stacks and mufflers at the Freeburg plant. Below: View of the exhaust side of one of the Superior engines showing Elliott-Buchi turbocharger

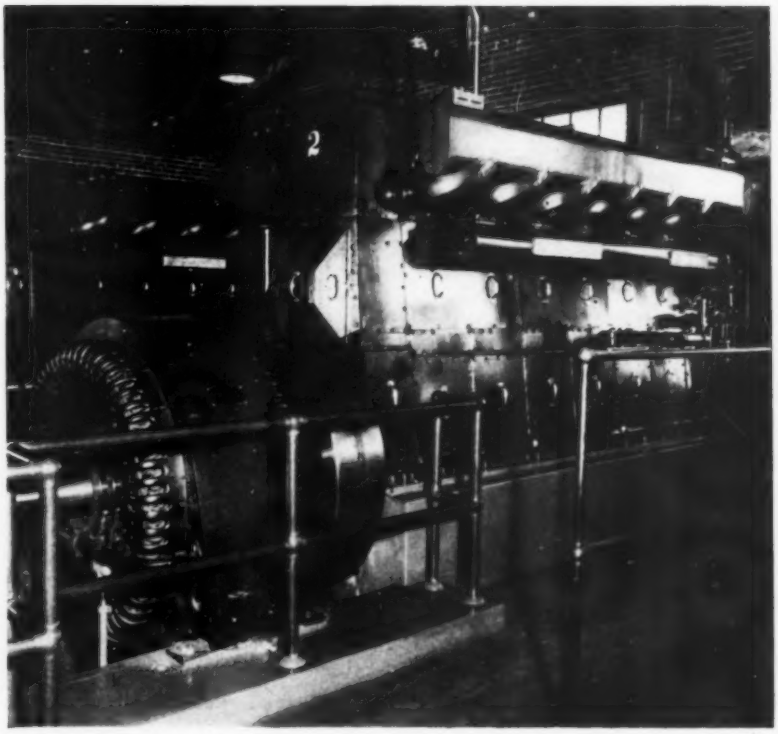


Table I.—Freeburg Diesel Operation for 9 Months of 1949

1949	Kw-Hr Generated	Gal Fuel	Gal Lube	Kw-Hr per Gal Fuel
Jan.	155,650	12,700	152	12.65
Feb.	139,660	11,060	136	12.62
Mar.	150,330	12,240	206	12.28
Apr.	139,920	11,555	175	12.11
May	138,070	11,450	183	12.06
June	143,430	11,760	126	12.19
July	155,800	12,680	134	12.28
Aug.	157,450	12,725	168	12.38
Sept.	151,450	12,410	157	12.21
Total	1,331,760	108,580	1,437	12.26

demonstrated the operating efficiency and economic soundness of the new equipment. Table I shows monthly figures on kw-hr generated, gal of fuel consumed, gal of lube consumed, and kw-hr per gal of fuel. In nine months the Diesels produced 1,331,760 kw-hr while consuming 108,580 gal of fuel; an average of 12.26 kw-hr per gal. A notable fact is that this efficiency level was achieved with an average load of less than 40%. For example, on October 11, 1949 the load varied between a low of 110 to a peak of 330 kw. Yet, fuel consumption was kept down to levels considered satisfactory in many plants with a far more favorable load factor.

Cost Comparisons

Economic improvement is shown in Table II which compares receipts and expenditures of the Freeburg electric department for the first nine months of 1949 with the corresponding period of 1948. While production was increased from 996,600 kw-hr in 1948 to 1,331,760 kw-hr in 1949, expenses were actually reduced by $7,501.75. With augmented revenue and production economy, a loss of $6,211.64 in the first three quarters of 1948 was translated into a net operating profit of $14,111.25 in the like period of 1949. The expenditures listed include the generating plant, distribution system, and business office.

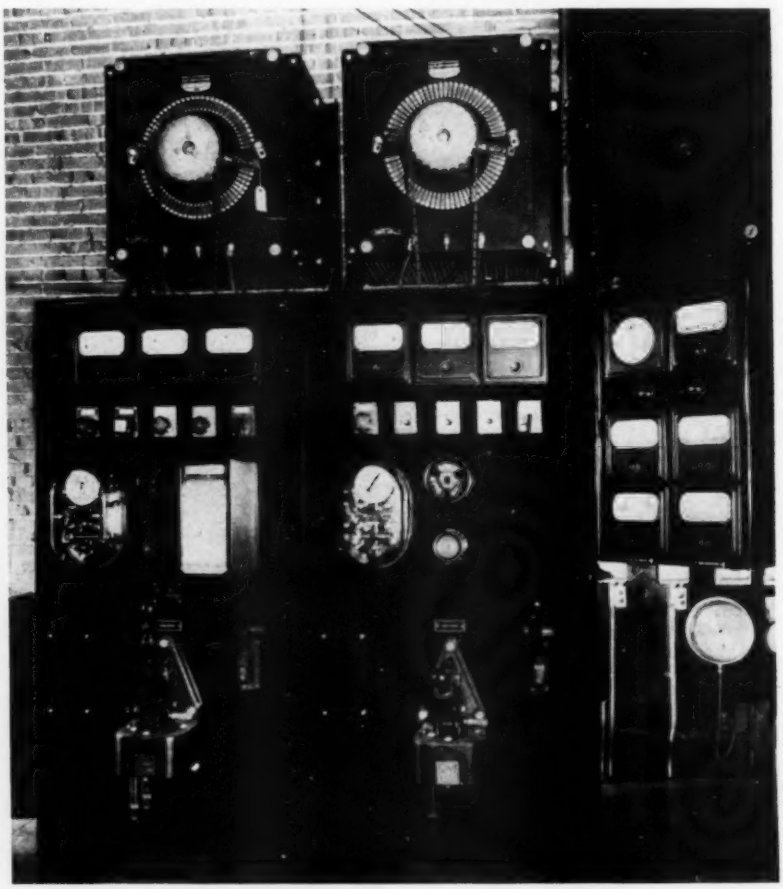
Comparison of fuel costs is of particular interest. For the periods considered, the cost of coal was $0.0192 per kw-hr. Diesel fuel cost was $0.0081 per kw-hr, a saving of $0.0111 per kw-hr. Natural gas should bring the fuel cost per kw-hr to less than $0.003. Further, the load is increasing steadily, and the improved load factor will mean greater engine efficiency as well as better fuel economy.

Some sacrifice in appearance resulted from utilizing part of the old steam plant building, but there have been no compromises on equipment quality, from the heavy-duty prime movers down to the smallest piece of auxiliary equipment, this plant was designed for long, efficient, and trouble-free service.

Accessories

A detergent-type lubricating oil is purified continuously in a four-element cellulose cartridge filter installed for each engine. During engine operation, oil is drawn from the pressure side of the engine lube pump discharged through the filter and returned to the sump tank. When the engine is not in service, a small motor-driven pump removes oil from the sump, discharges it through the filter, and returns it to the sump. Included in the lube oil system are two shell-and-tube oil coolers. Fuel oil delivered in tank trucks to a 15,000 gal tank is pumped through meters, two-element cellulose filters, and into two 250-gal elevated day tanks located inside the plant. Flow to the engines from the day tanks is by gravity.

Air for the engines is drawn through a two-element viscous-impingement type filter located outside the building and is delivered to the cylinders under



Diesel engine panels and swinging synchronization panel were installed with the two new engines. Eventually, the old board (background) will be removed

pressure by an exhaust-driven turbocharger. Exhaust gases are vented through vertical silencers.

Two evaporative coolers and two motor-driven centrifugal circulating pumps are the principal elements in a closed cooling system. Thermostatically-controlled shutters on the coolers keep jacket water at specified temperature. Normally one cooler and one pump are employed for each engine, but the piping permits alternate or combined operation of pumps and coolers. City water is treated in a softener before it is used for makeup.

Dual Control Panels

Each engine has a control panel that contains an exhaust pyrometer and alarms for engine lube presure, turbocharger lube pressure, jacket water temperature, and overspeed. In addition, gauges and a tachometer are located on the engine. Distribution is still handled from the old switchboard, but two new engine panels and a swinging synchronizer panel were installed for eventual replacement of the old board.

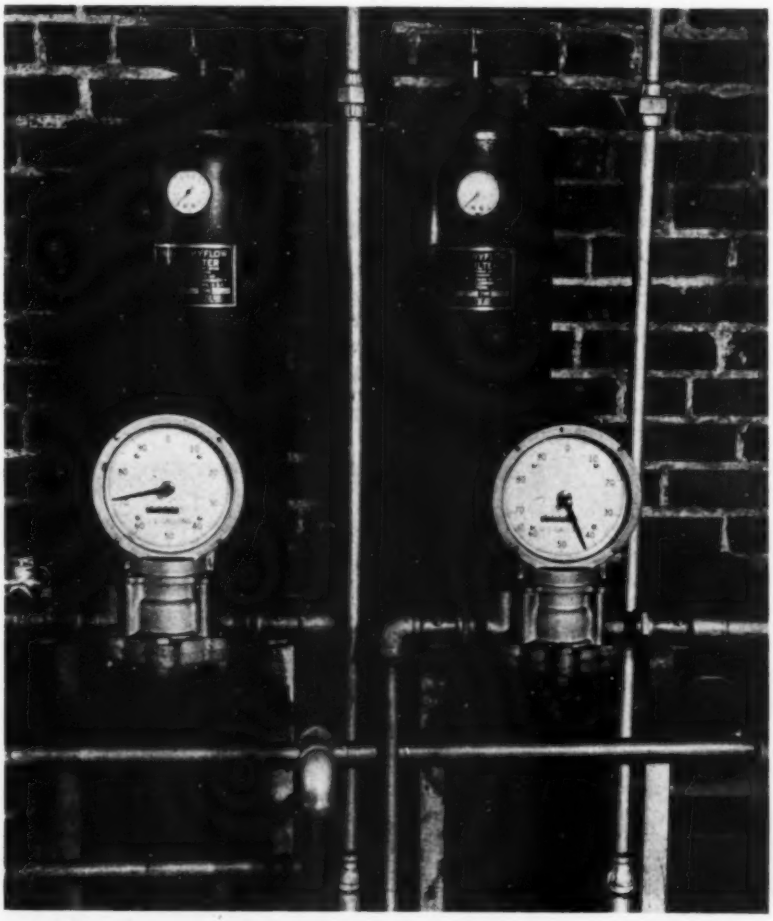
Table II.—Receipts and Expenditures—Freeburg Electric Dept.

	First 9 months 1949	First 9 months 1948
Receipts	$47,701.84	$34,880.70
Salaries	9,645.00	10,860.15
Addit. Labor	152.55	791.10
Fuel	10,841.63	19,169.89
Lube, Supplies, Maintenance	6,534.54	5,419.05
Meter Refunds	445.00	510.00
Sales Tax	1,207.99	1,016.49
Miscellaneous	4,763.88	3,325.66
Total Expenditures	33,590.59	41,092.34
Net Oper. Profit	14,111.25 (Profit)	6,211.64 (Loss)

Two compressors supply starting air. One is driven by motor, the other by a gasoline engine. The first unit is controlled automatically to keep 200 to 240 psi presure in the air tanks.

Normal sequence of operation calls for one engine to be on line for a full week, with the reserve engine providing complete standby protection. The Diesels have enough capacity to allow for substantial load expansion, and there is room in the plant for additional units when the need arises. Despite the initial unfavorable load factor, Freeburg's Diesels have proven their value to the community.

Operation is supervised by Cornelius Nold, superintendent of the light, water, and sewage department. Major policy matters are determined in consultation with village president Louis M. Schwalb and a six-man Board of Trustees. The business office is managed by village clerk Robert Browning.



All fuel oil is metered and passed through cellulose filters before removal

FREEBURG, ILL., MUNICIPAL POWER PLANT

PRINCIPAL EQUIPMENT

Engines: Super Engine Div., The National Supply Co.
Generators: Elliott-Buchi
Turbochargers: Elliott-Buchi
Governors: Woodward Governor Co.
Fuel Oil: Standard Oil Co. of Indiana
Unloading Pump: Gorman-Rupp Co.
Transfer Pump: Geo. D. Roper Co.
Fuel Meters: Buffalo Meter Co.
Fuel Filters: The Hilliard Corp.
Level Gauges: Rochester Mfg. Co.
Lube Oil: Standard Oil Co. of Indiana
Lube Filters: The Hilliard Corp.
Oil Coolers: Ross Heater & Mfg. Co.
Evaporative Coolers: Marlo Coils Co.
Thermostatic Controls: R. S. Products Corp.
Water Pumps: Ingersoll-Rand Co.
Water Softener: Elgin Softener Corp.
Air Filters: Air-Maze Corp.
Exhaust Silencers: Maxim Silencer Co.
Air Compressors: Quincy Compressor Co.
Control Panels: The National Supply Co.
Exhaust Pyrometer: Illinois Testing Laboratories
Switchboard: Lake Shore Elec. Mfg. Co.
Voltage Regulators: Burlington Instrument Co.

PREVENTIVE MAINTENANCE KEEPS BIG EQUIPMENT MOVING

With a carefully planned program of service and record-keeping, the largest coal strip mining operation in the world holds its 'round-the-clock schedule and keeps huge equipment at work without interruption

SERVICING and maintenance to insure steady operation of production equipment is vital to industry, but it requires constant and consistent attention to details. Hanna Coal Company, Georgetown No. 12 Mine has installed a system of service and service records which adequately handle hundreds of units of coal mining machinery. The same material could be utilized, with necessary modifications, in many other fields.

The Job Outline

Power shovels equipped with 50, 45, and 20 cu yd dippers remove 3½ million cu yd of dirt and rock overburden a month. In fact, this strip mine makes available some three million ton of coal a year. To attain a daily production of 20,000 ton, all mining equipment must be in top operating condition 24 hours a day. To see that top performance exists, the maintenance shop operates on a round-the-clock schedule. Each man is schooled in the work he performs, and each man takes pride in a job well done. Furthermore, slogans, such as "Dirt is a motor's worst enemy—be clean," play a part to keep employes reminded of the all-important maintenance function. The shop maintains, repairs, and services all equipment including pumps, welding machines, air compressors, service trucks, haulage trucks, power shovels, road patrols, sweepers, drills, and tractors. Engines serviced can range in size from single cylinder gasoline engines that power 3 in. pumps—to multi-cylindered Diesel outfits on shovels and tractors. The shop has both personnel and equipment to maintain service on a wide variety of machines over a 4 to 6 mile operation, five days a week.

Preventive maintenance is the key to the Georgetown system, and lubrication, in the shop and in the field, is an important part of trouble prevention. Grease and oil cans are not found on the operation, for the shop has hose reels that can reach every area needing lubrication in the service line. Field trucks are supplied with oil from a shed located outside the building through pump lines. With this method, some 100 gal are supplied daily. A well equipped tire shop contains 1400 tires to service the heavy duty units. Earthmoving rigs are scheduled on 500, 1000, and 2000 hours checks, with a complete rebuild job at 8500 hours. Also included in these checks are pickups, haulers, and heavy duty units that require close maintenance.

Cost Factors

Determining operating, maintenance, and daily servicing costs is quite a problem, but a plan was set up to evaluate each item. Trial and error methods resulted in a clearly detailed breakdown of preventive maintenance costs. Charts for the various departments are posted daily. A filing system contains information on each piece of serviced equipment and also includes a complete breakdown of parts, fuel and transmission records, operating data, and other necessary entries that give the overall story on each item owned by the mine. Various forms compiled by the service division are covered in the following outline: (1) Maintenance costs, (2) Operating costs, (3) Daily record gasoline fuel oil issued, (4) Bulldozer lubrication, (5) Tractor operating, (6) Truck odometer readings, (7) Job records, (8) Daily time reports, and (9) Warehouse requisitions.

An interesting feature of this pro-

General view of machine shop and shovel repair division. A tire shop with 1400 tires services heavy-duty units

Checks on heavy equipment at 500, 1000 and 2000 hour intervals is integral part of Hanna's maintenance program

Georgetown No. 12 Mine's field service truck built by the service shop. The rig, with five hose reels for oil, water and grease, services dozer equipment in the field

No oil cans are found in the shops or in the field. These drums supply oil and grease to the service truck, using pressure lines; 100 gal is handled during an average day

gram is the installation of odometer card units in trucks, which reveals whether the operator is lugging the engine unnecessarily, taking time out for lunch, and general operating data that can be evaluated at a glance. Time slips, fuel chart forms, lubrication data, and requisition entries are given close scrutiny and entered in a monthly ledger. From this procedure, operation cost and performance are known by noon the next day. To keep a cross check in the shop servicing, operators in the field make out trouble sheets concerning equipment they operate. In all, from simple daily job information to major overhaul, the service records are complete on individual machines.

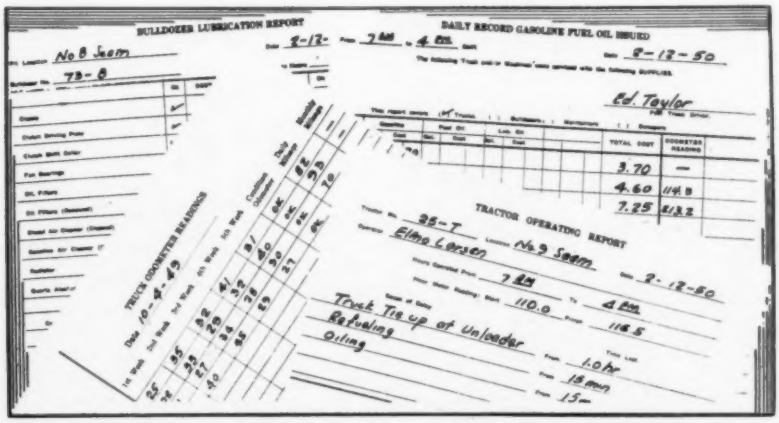
Service Requirements

Equipment maintenance and service requirements can be understood better by considering the operation of strip pit mining which extends over a 4 x 6 mile area. Overburden of the No. 8 coal seam consists of 20 to 25 ft normal roof of limestone at which point a rider seam is met. Above this seam lies 25 ft of fresh water limestone, sometimes referred to as "fish-pod limestone". Topping this layer of overburden is sandstone shale. However, at times this formation will change to layers of laminated sandstone or massive sandstone. The overburden is blasted with liquid oxygen. Blasting is accomplished by the application of electrically powered rotary sidewall drills mounted on a platform built upon a converted drilling machine. The overburden of the No. 8 is approximately 80 ft, but the maximum overburden stripped was 95 ft.

Top seam stripping is designated as No. 9, or sewickley coal seam. The overburden consists primarily of sandstone shales and fresh water limestone boulder formation. The overburden in this seam is stripped to a maximum of 70 ft., but the average depth is usually 60 ft.

Working the five foot seam is spectacular in operation, because of the tonnage steadily taken from the earth, and the operation of the large shovels. Pit workings usually vary from ¼ to 2½ mile from six tipples which are fed from hauling trucks. Before loaders feed coal into the trucks, motor graders scarify exposed bone off the top of the coal. Broom units move over the cleared seam and clean the exposed area. Shovels then work the seam and load the trucks. Bulldozers aid stripping overburden with big 45 yd shovels. After proper preparation, the coal is fed into railroad cars with production of one tipple reaching as high as 1000 ton per hour.

Production such as experienced at this mine necessitates a considerable outlay of money in equipment, material, and labor. Working round-the-clock, the lifeblood or mainstay behind this operation is the service program.

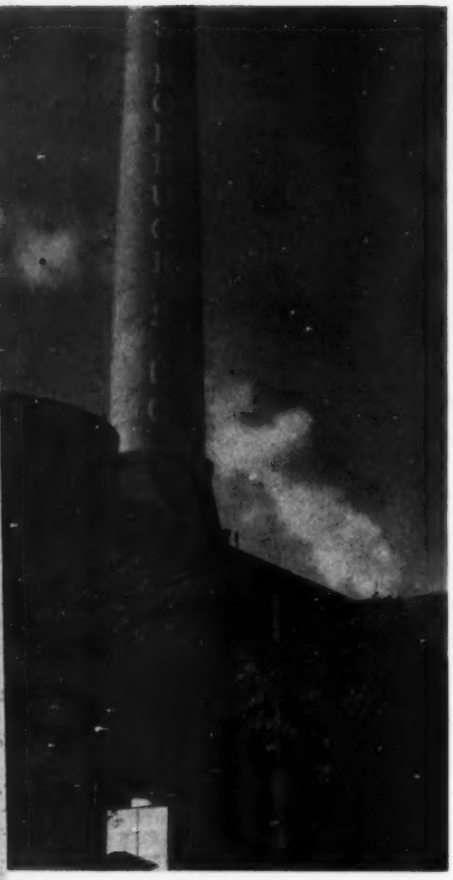

BULLDOZER LUBRICATION REPORT

DAILY RECORD GASOLINE FUEL OIL ISSUED

TRACTOR OPERATING REPORT

TRUCK ODOMETER READINGS

Accurate operating, maintenance and daily servicing costs are maintained on standard record forms. Trouble reports are submitted daily by field operators



SEARS SAVES WITH STEAM-DIESEL COMBINATION

Power supply and space heating requirements at Sears, Roebuck & Company Kansas City plant are met with a steam-Diesel combination that also resulted in substantial reductions in operating costs

WILLIAM H. GOTTLIEB, Morrison-Gottlieb, New York

Power plant of the Sears, Roebuck Co. establishment in Kansas City houses four steam units and the new Diesel. In foreground are the Maxim exhaust silencer and the Marley cooling tower

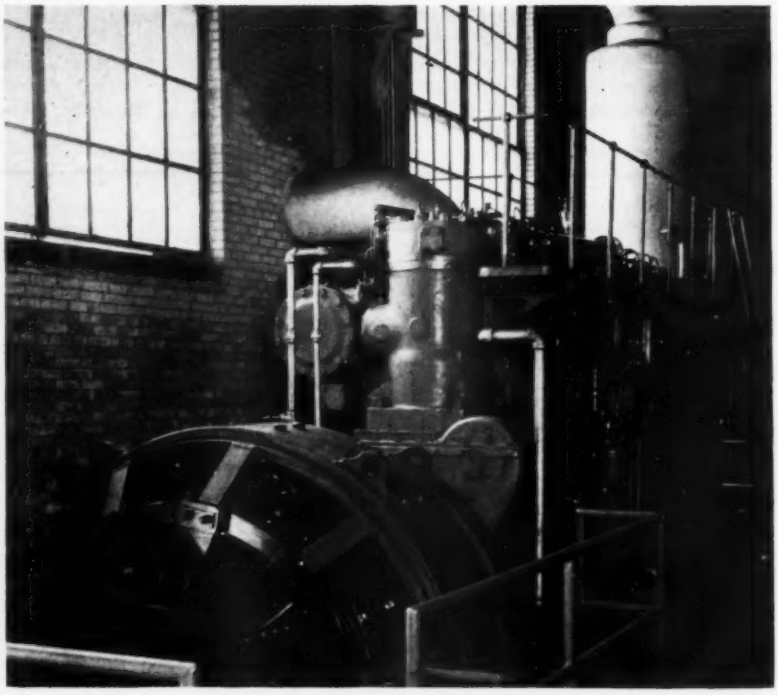
The 805-hp Diesel drives a 550-kw, 220-volt d c generator. In the first year of full operation, it produced more than 1,400,000 kwh for Sears, Roebuck at a saving of about $12,000

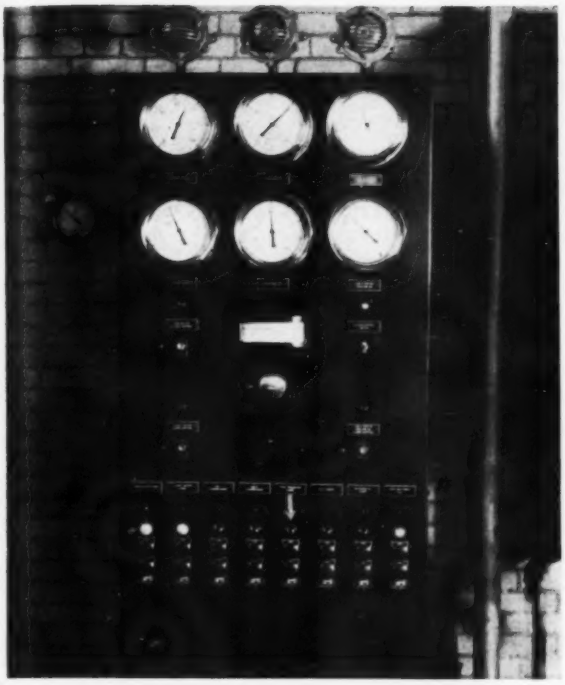
WHEN the Sears, Roebuck & Co. plant at Kansas City first started generating its own power it installed a steam plant as steam was needed for space heating as well as power to operate elevators, air conditioners, and lighting. Currently this steam plant includes three steam engines of 150, 500, and 750 kw capacity, and a 500 kw steam turbine. As the power load increased, with the addition of lighting, fans, conveyors, and compressors, it became apparent the plant was out of balance. Large quantities of steam were needed for power above the requirements of the heating system, and steam-generated power proved expensive.

Sears engineers sought to rectify this situation by installing—in October 1947—an 805 hp Diesel generator. Since this unit was put on the line, it has run 10 hr. a day, six days a week, throughout the year. However, the Diesel operation depends entirely upon the heat load that has to be carried. During the six months when the heat load is low, the Diesel is loaded to capacity. The other six months, as steam is required for the heating system, the steam engines operate at capacity, and the Diesel provides the rest of the electrical power.

In the first full year of Diesel operation, the steam plant generated 3,170,050 kwh, and the single Diesel produced 1,437,950 kwh. Even with an allowance for the value of steam supplied during the heating season, the average cost of generating power with the steam equipment is $0.018 per kwh, which includes fuel, lubricating oil, supplies, and maintenance. The comparable cost of power production with the Diesel is $0.009 a kwh, a saving of 50%.

Table I shows the saving the first full year of Diesel operation. The





Panel has pyrometers, pressure and temperature gauges, and controls for the Diesel accessories

Lubricating oil is pumped continuously through this filter to sump. Oil has never been changed

table is based on Sears' 13-month calendar and the figures are given for the 13 periods that make up their year. Based on the comparative costs of steam and Diesel power, the Diesel earned $12,941.55, during this period.

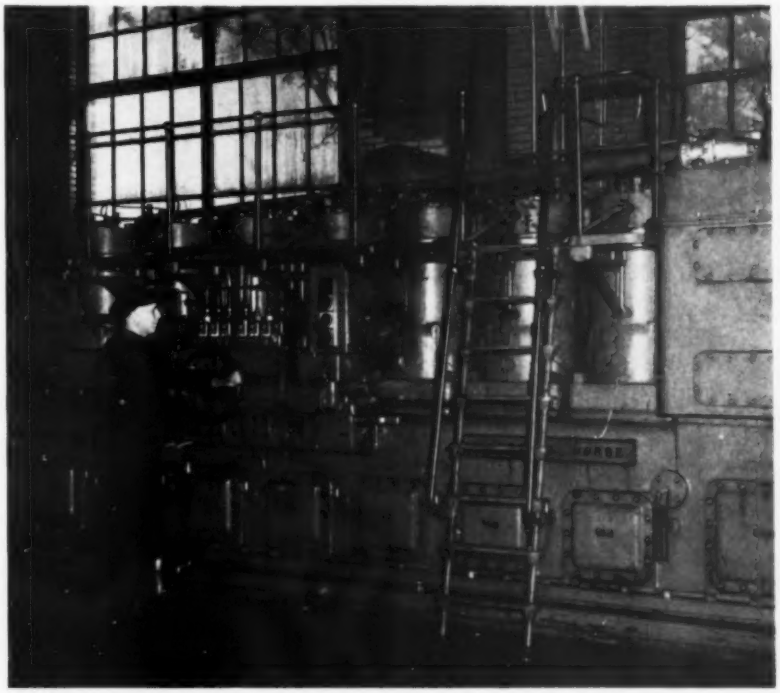
Equally important has been the continuity of service, as the Diesel has run more than 7,000 hr. without a single enforced shutdown. In more than two years of service, the engine has been off the line only two days for overhaul and the reconditioning was done over the weekend, without disrupting the normal operating schedule.

To achieve the desired production efficiency and assure dependable service over a long period of years, a heavy duty prime mover was selected. The Diesel is a seven cylinder, two-cycle 14 in. bore and 17 in. stroke, and develops 805 hp at 300 rpm. The engine is direct connected to a 550 kw, 220 volt d-c generator.

Sears policy is to provide good fuel, lubricating oils, and protective accessory equipment to keep operating conditions as close to ideal as possible.

For this reason an additive lubricating oil is employed, both in the cylinders supplied by forced feed lubrication, and in the pressure system which lubricates the bearings and cools the pistons. The pressure system contains a shell-and-tube oil cooler, a strainer, and a motor driven auxiliary lube pump which operates before the engine starts and after it shuts down. A waste-packed, cartridge-type bypass filter is in continuous operation. In this system a pump draws oil from the sump, discharges it through the filter, and returns it to the sump.

Changing oil has not been necessary, as the filtering system has given excellent results. Recently, when pistons were pulled, after 18 months of opera-



Paul Swan at the control wheel of the Diesel reports that there has not been a shutdown in more than two years. The governor and the fuel injection pumps can be seen in this view of the engine

tion, there were no stuck rings and very little carbon or sludge. Cylinder wear has been slight and bearing wear negligible.

Fuel is a high quality 37 gravity Diesel oil. The oil is unloaded from tank cars by a motor driven rotary pump into a 15,000 gal tank above ground outside the power house. Transfer of oil to a 500 gal day tank is through a meter located in the engine room. A built-in engine supply pump draws fuel from the day tank through a duplex filter.

Cooling Water

Cooling water is circulated through the engine jackets and heat exchanger by a motor driven centrifugal pump. A companion pump discharges raw water through the exchanger and an induced-draft cooling tower. A thermostatic control bypasses jacket water around the exchanger to maintain prescribed temperature in the engine. Chemicals are added to soften the jacket water, and the plant has had no trouble with scale formation. So-called "raw" water also is treated but to a lesser degree.

Scavenging Air

Air for Diesel scavenging is drawn through an impingement-type filter and an intake snubber. Exhaust gases pass through a vertical silencer to the outside of the building. The engine is started with compressed air supplied by either of two motor driven compressors.

A compact gauge, alarm, and auxiliary control panel facilitates operation and provides protection against mishap. This single panel contains a multi-point exhaust pyrometer, jacket water and lubricating oil, pressure and temperature gauges, raw water and starting air pressure gauges, raw water, jacket water, and lube temperature and pressure alarms. In addition, push-button controls operate the two water pumps, two air compressors, fuel transfer pump, auxiliary lube pump, scraper oil pump, and cooling tower fan, as well as other auxiliaries.

SEARS—TABLE I

One Year of Diesel Operation

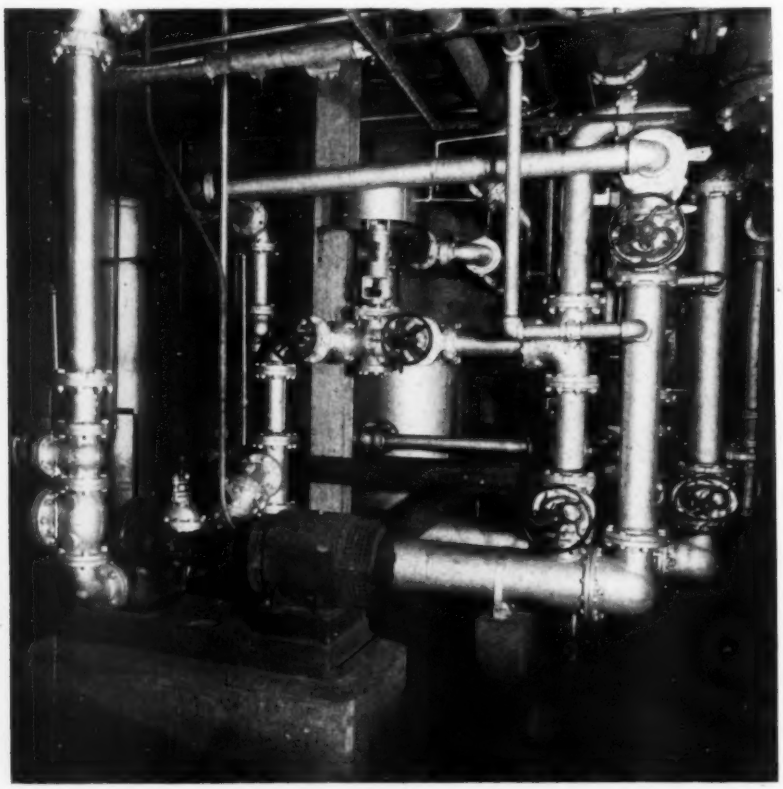
1948 Period	Kwh Generated Steam	Kwh Generated Diesel	Diesel Fuel, Gal	*Savings Through Use of Diesel
Jan. 1-28	306,150	89,850	7,718	$808.65
Jan. 29-Feb. 25	261,650	79,350	7,252	714.15
Feb. 26-Mar. 25	254,200	112,800	9,237	1,015.20
Mar. 26-Apr. 22	232,100	111,900	9,700	1,007.10
Apr. 23-May 20	229,650	103,350	9,115	930.15
May 21-Jun. 17	207,900	119,100	10,804	1,071.90
Jun. 18-Jul. 15	229,200	121,800	11,284	1,096.20
Jul. 16-Aug. 12	242,500	122,500	10,483	1,102.50
Aug. 13-Sept. 9	225,400	108,600	9,406	977.40
Sept. 10-Oct. 7	264,600	125,400	10,675	1,128.60
Oct. 8-Nov. 4	227,000	124,000	10,376	1,116.00
Nov. 5-Dec. 2	240,500	113,500	9,488	1,021.50
Dec. 3-Dec. 31	249,200	105,800	9,034	952.20
Totals	3,170,050	1,437,950	124,572	12,941.55

*Based on average cost per kwh for Diesel for year compared with average cost per kwh for steam minus allowance for heating.

This table is based on Sears' 13-month calender, and the figures are given for the 13 periods that make up their year

PRINCIPAL EQUIPMENT

Diesel-Turbine—Fairbanks, Morse & Co.
Generator—Allis-Chalmers Mfg. Co.
Fuel Oil—Standard Oil of Indiana
Fuel Unloading pump—Fairbanks, Morse & Co.
Fuel Transfer pump—Fairbanks, Morse & Co.
Fuel Meter—Neptune Meter Co.
Fuel Filter—Wm. W. Nugent & Co., Inc.
Governor—Woodward Governor Co.
Lube Bypass Filter—Midwest
Aux. Lube Pump—Fairbanks-Morse & Co.
Lube Strainer—Purolator Products, Inc.
Oil Cooler—Ross Heater & Mfg. Co., Inc.
Heat Exchanger—Ross Heater & Mfg. Co., Inc.
Cooling Water pumps—Fairbanks, Morse & Co.
Cooling Tower—The Marley Co.
Chemicals, water—National Aluminate Corp.
Water Temp. Controls—Leslie Co.
Intake Snubber—Burgess-Manning Co.
Exhaust Silencer—Maxim Silencer Co.
Compressor—Fairbanks, Morse & Co.



This motor-driven centrifugal pump is used to circulate engine cooling water to heat exchanger and Diesel jackets. Thermostatic control keeps temperature at 150°F, using a heat-exchanger bypass

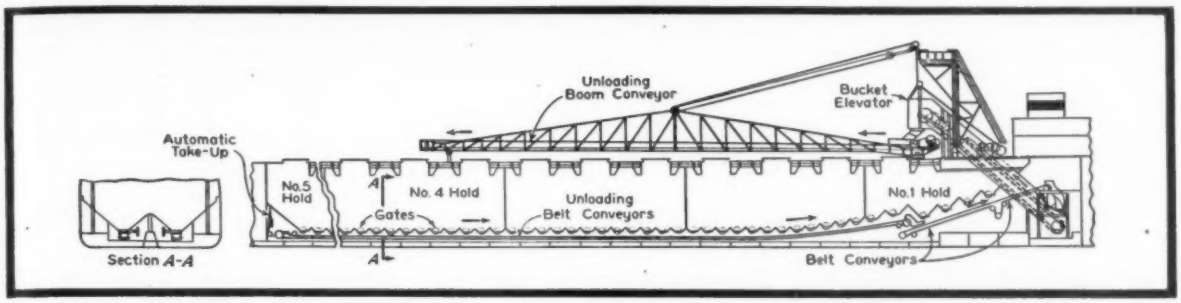


Fig. 1—Lake-type unloader handles 1400 tons of coal an hour

PROPER COAL HANDLING METHODS REDUCE COSTS

Reserve coal storage piles are vital to supply needed coal during a crisis, such as just experienced. The author explains how this reserve can be handled with greatest efficiency and economy so as to meet any emergency

WILBUR G. HUDSON, Consulting Engineer

THE disastrous interruption of the flow of mined coal in the winter just passed has emphasized the importance of the largest possible reserve storage capacity. This is true for both industrial plants and utility stations, and steps must be taken to prevent the recurrance of such crises, or at least reduce their impact.

Reclaiming ground storage increases coal-handling cost 100% or more—but today the problem is to have the coal! In large generating plants, where the coal rate is not over one pound per kw-hr, cost of handling is only about 4% of the total production cost. However, reliability of the coal handling equipment is an important matter, and it must be ready to function whenever needed. With skillful engineers, the equipment will operate year after year with a maintenance cost of less than 1/10 cent per ton.

Public utility plants usually establish as fixed charges: taxes and insurance 2%, depreciation 7%, interest 5%, and maintenance 2%, or a total of 16%. Table I lists the costs for nine utility stations that range from 14,250 to 74,500 kw capacity. The labor cost is based on an average annual wage of $1500 per man. All these stations receive coal by rail.

Coal handling installation at station H cost approximately $150,000, and the total annual cost per ton was: labor 8.7 cents, fixed charges 15.5 cents for a total cost of 24.2 cents.

Maintenance and operating costs, for coal handling at 14 other utility plants that burn from 40,000 to 547,000 tons of coal per year, are listed in Table II. Labor costs are fairly uniform, but with the addition of fixed charges the total cost per ton differs widely. Generally, the investment for stations receiving coal by water is very high, for items such as investment for dock, tracks, pits, as well as the handling equipment are included. Table II is set up so the fixed charges are an arbitrary 12% of the investment. The average total handling cost is 37.6 cents per ton.

Along the Great Lakes some waterside stations have the advantage of delivery by self-unloading vessels with unloading rates up to 2000 ton per hr. Capacities are 10,000 ton or more, and the major portion of each cargo must first be ground stored and later re-handled (Fig 1). At tidewater plants, with coal received in open barges of small capacity, there is an investment in an unloading tower or high capacity crane, but the major portion of the cargoes can go direct to the bunker. Fig. 2 shows a waterside 120,000 kw plant with steeple tower, that has a barge unloading capacity of 550 ton per hr. The bunker capacity is 1800 ton. In this instance, the re-

TABLE I

Labor Costs at Plants Using 40,000 to 172,000 Tons per Year

Station	Kilowatt Capacity	Tons per Year	No. of Handlers	Annual Cost	Labor Cost per Ton, cents
A	14,250	39,900	2	$ 3,000	7.7
B	31,000	88,600	3	4,500	5.0
C	20,000	71,500	3	4,500	6.0
D	23,500	55,800	4	6,000	25.5
E	72,500	118,365	6	9,000	8.05
F	74,500	86,500	7	10,500	12.20
G	53,000	43,700	8	12,000	28.0
H	55,000	154,500	9	13,500	8.7
I	65,000	172,000	14	21,000	12.2
				Average	12.6 cents

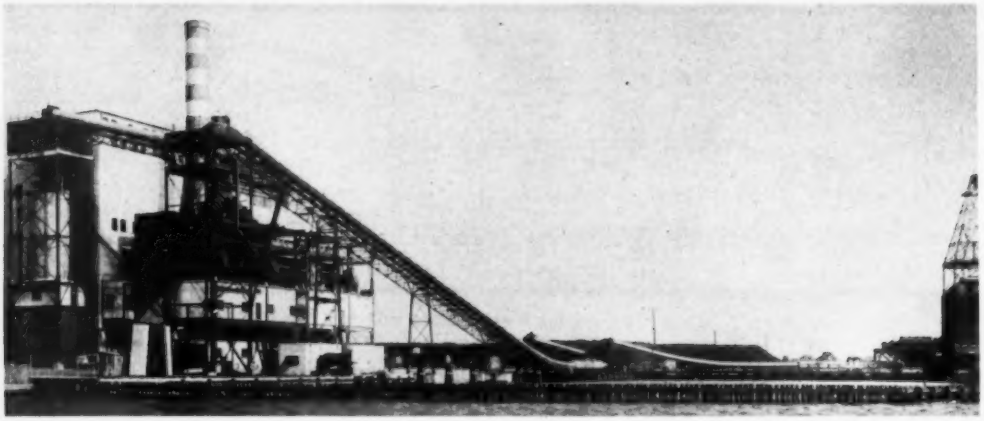


Fig. 2—Practice at this 120,000 kw waterside plant is to unload coal by steeple tower from the company barges; capacity is 550 tons per hour. Major movement is to bunkers of 1800 tons capacity. The surplus is diverted to ground storage by a stacker belt seen at the foot of incline conveyor

serve storage is stocked behind the tower by carryall and bulldozers.

Mechanical unloading at plants requiring, say, 25 cars per year seldom can show any return on the investment. Local contractors often will unload coal at $25 per car. However, a simple unloader with a capacity of 25 ton per hr and costing about $3000 installed, provides prompter release of cars with less labor and dust nuisance. For one or two cars per week, mechanical handling is worth while.

Handling Damp Coal

Small washed coal, which is frequently damp and sticky, offers the serious problem of starting the coal to flow from hopper-bottom cars. Frequently two men must work a day or more to clear a single car if the coal is slightly frozen. Mechanical car shakers costing about $6000 (plus cost of supporting structure) will unload a car in 10 minutes or so, but the necessary investment is too great for the small plant. However, simplified shakers that cost $1600 or less do a fair job. Side panels of a car act as a sounding board and the possibility of complaints from this noise should be investigated before purchasing mechanical car shaker. A plant located where winters are severe suffers still higher unloading costs, as coal becomes frozen in transit. Shakers alone cannot send down coal that has formed into a frozen mass. Pre-thawing, preferably by a radiant heater in a concrete trench between ties is necessary. Such a heater costs about $2000 installed and will thaw a loaded car of coal into workable condition at a cost of about $1 for fuel oil. By way of contrast, a car was recently observed on a siding in a badly frozen condition. Three men had been working on the load with picks all day, and apparently another day would be required. That unloading job cost about $1 per ton.

Extended research by the U. S. Bureau of Mines with New River, Pocohontas, and Pittsburgh Gas coals showed that outdoor weathering caused no heat loss greater than 1.2% the first year or 2.1% in two years.

TABLE II

Maintenance and Operating Costs of Handling Coal at Plants Using from 40,000 to 547,000 Tons per Year

Coal Delivered by Water, Rail or Truck	Year Installed	Capacity to Bunkers, tons per hour	Cost of Installation Including Docks, Tracks, Pits, Cranes, Conveyors, etc.	Years Represented by Data	Tons per Year	Maintenance Cost, cents per ton	Operating Labor, cents per ton	Total Operating Costs, cents per ton	Fixed Charges, cents per ton	Total Fixed and Operating Costs, cents per ton	Description of System
W	1939	400	$691,000	1940	124,000	1.3	5.0	6.3	67.0	73.3	Coal delivered on dock by self-unloading lake boats, gantry crane to storage or to belt conveyors to plant. (Fig. 14—6)
W	1925	350	1,220,000	1937-39	382,046	5.3	7.6	12.9	38.1	51.0	Gantry crane from lake boats to storage, or by car and belt conveyor to plant. Auxiliary drag line storage.
W	1926	250	655,000	1938-40	547,574	4.2	4.0	8.2	14.4	22.6	Clamshell from river barges to belt conveyors to plant or to Lidgerwood storage.
W	1928	125	978,000	1935-40	175,879	4.8	6.6	11.4	66.8	78.2	Clamshell from ocean steamers or barges to belt conveyors, to plant or to drag line storage.
R	1939	200	360,000	1940	196,000	0.7	6.1	6.8	22.0	28.8	Cars discharge by gravity into pit, to belt conveyors, to plant or to drag line storage.
R & T	1939	125	160,000	1940	122,924	4.5	6.4	10.9	15.8	26.7	From cars by gravity to pit, to belt and bucket elevator, to drag line storage, or to plant by belt.
R	1936	100	212,000	1940	79,360	1.9	7.5	9.4	32.0	41.4	From cars by gravity to pit, to belt and bucket elevator, to drag line storage, or to plant by belt.
R	1913	75	66,000	1936-38	109,000	2.4	5.3	7.7	7.3	15.0	Stationary tower with clamshell bucket from cars to distributing belt. Locomotive crane for storage.
R	1925	75	112,000	1936-38	217,588	2.1	4.4	6.5	6.3	12.8	Locomotive crane with bucket unloads cars to pit, to chain and bucket elevator, to scraper conveyor. Locomotive crane for storage.
R	1927	60	160,000	1938-40	62,606	6.1	9.8	15.9	30.7	46.6	Cars discharge by gravity into pit, to belt and bucket elevator, to scraper conveyor. Locomotive crane for storage.
R	1928	60	164,000	1937-39	43,860	4.9	10.1	15.0	45.6	60.6	Cars discharge by gravity into pit, to belt and bucket elevator to scraper conveyor. Bridge crane for storage.
R	1926	50	97,000	1937-39	54,636	4.8	8.1	12.9	21.5	34.4	Cars discharge by gravity into pit, to belt and bucket elevator, to scraper conveyor. Bridge crane for storage.
R	1920	40	20,000	1939-40	40,077	3.4	6.7	10.1	6.0	16.1	Cars discharge by gravity to shallow pit, to inclined scraper conveyor, to bunkers. Storage by portable conveyor.
R	1937	150	185,000	1940	275,376	...	...	10.6	8.1	18.7	Cars dumped into pit, to skip hoists, to belt distributors. Storage by locomotive crane and bulldozer.
					Average	3.6	6.7	10.3	27.2	37.6	

TABLE III

Carryalls towed by Track Type Tractors.

Approximate tons of coal moved per 50 minute hour.

Capacity, heaped—tons	5.4	7.45	10	15.5
Total operating cost per hour*	$3.75	$4.50	$5.50	$7.00
One way haul, ft				
200	70	106	154	230
300	59	90	131	197
400	51	78	115	172
500	45	69	101	153
600	39	60	89	135
700	36	54	81	123
800	33	50	74	113
900	30	46	68	104
1000	28	43	63	97
1200	24	37	55	84
1400	—	33	49	75

*Operating figures include depreciation, interest, insurance, fuel, oil, operator's wages, parts, and miscellaneous labor.

Fig. 3—Carryalls, track-tractor towed or self-powered, are standardized for loads to 30 tons. Drag scraper is used to stock-out and reclaim reserve storage when handling capacity is not large enough to warrant using carryalls

Subbituminous Wyoming coal suffered more—up to 3% loss in one year and 5.5% in five years. Oxidation of Appalachian coals starts at about 85°F. and increases rapidly with temperature increase. With lower grades the oxidation temperature is lower. Adverse factors are the presence of pyrites and large exposed area. There is no heating tendency and very little weathering loss in anthracite. For active large ground storage capacities, the bulldozer and carryall are favored (Fig 3). Over reasonable distances the handling cost is low, and coal, subject to spontaneous heating, is compacted by the treads of the machines.

One company discharges coal by a self-unloading vessel into compact 6 in. layers and to a pile depth of 30 ft, with no observed heating. The statistical report for operations totalling of 388,000 ton is:

Spread and packed per hour	118 ton
Total trips	39,300
Average trips per hour	12
Average load	9.88 ton
Average haul (round trip)	900-ft

The power house is several miles from the storage. Coal is reloaded into 70 ton cars by crane with 3 ton bucket having a free digging capacity of 400 ton per hr under favorable conditions. Cost of stocking out from dock to pile, including labor, maintenance, charge-off in five years, leveling, and compacting, averages 3 to 4 cents per ton. Reloading to cars averages about the same.

Manufacturers of heavy duty bulldozers and carryalls standardize for carrying loads to 30 tons. Figures in Table III are typical for carryalls.

Handling costs per ton reported for the method shown in Fig 4 agree closely with the data in Table III for the same round trip. However, such equipment is too costly for smaller plants. Where the trip length is under 200 ft, a bulldozer accomplishes the job at a lower investment. The bulldozer pushes the load, spilling coal around the ends and replacing the spillage as it moves forward. Handling capacity ranges from 50 to 100 ton per hr with an operating cost of between $4 and $5 per hour, including labor, depreciation, interest, insurance, supplies, and maintenance.

Another coal handling method that is available is the drag scraper. Smaller installations, for a capacity of, say, 50 ton per hr when stocking out or reclaiming over a radius averaging 100 ft, will cost about $10,000, which includes foundations. For such small capacities operating costs are substantially lower than for the bulldozer.

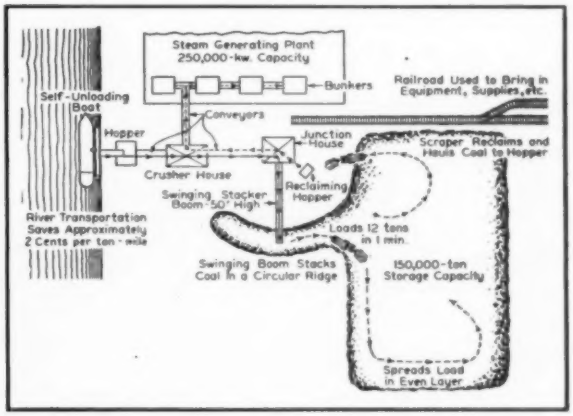

Steam Generating Plant 250,000-kw. Capacity
Bunkers
Railroad Used to Bring in Equipment, Supplies, etc.
Self-Unloading Boat
Conveyers
Hopper
Junction House
Scraper Reclaims and Hauls Coal to Hopper
Crusher House
Reclaiming Hopper
Swinging Stacker Boom-50' High
River Transportation Saves Approximately 2 Cents per ton-mile
Loads 12 tons in 1 min.
Swinging Boom Stacks Coal in a Circular Ridge
150,000-ton Storage Capacity
Spreads Load in Even Layer

Fig. 4—This plant, originally of 50,000 kw capacity, with coal delivered by rail, expanded to 250,000 kw with delivery by self-unloading vessels and reserve storage increased from 50,000 tons to 150,000 tons. Coal is piled in semi-circular ridge by stacker belt and distributed by two carryalls. Coal is spread in 6 in. layers and compacted to prevent spontaneous ignition

LOW COST AUXILIARY POWER FROM TURBINE DRIVES

Increment costs of boilers to give higher pressure than normally required for process may bring high return on the investment if pressure differential is used for generating by-product power

B. MADDOCK

INDUSTRIAL process and manufacturing plant often require 50,000 to 70,000 lb per hour of steam starting at 150 psi down and ranging to 10 psi. The question arises as to how much power can be generated, what will be the additional capital expenditure, and how much will the resulting power cost if higher pressure boilers are installed? If the assumption is made that all power produced with a 70,000 lb per hr non-condensing unit can be put to useful work and all the power will be converted to electrical energy, a standby or duplicate installation is not necessary. Under these conditions the capital charges will be the minimum.

If the general process steam requirements are in reasonable balance only one engine exhaust pressure is needed—say 150 psi. Under the assumed conditions the total exhaust heat then will have to supply all process requirements and should be equal to 70,000 x 1196=83.7 MMBtu/hr.

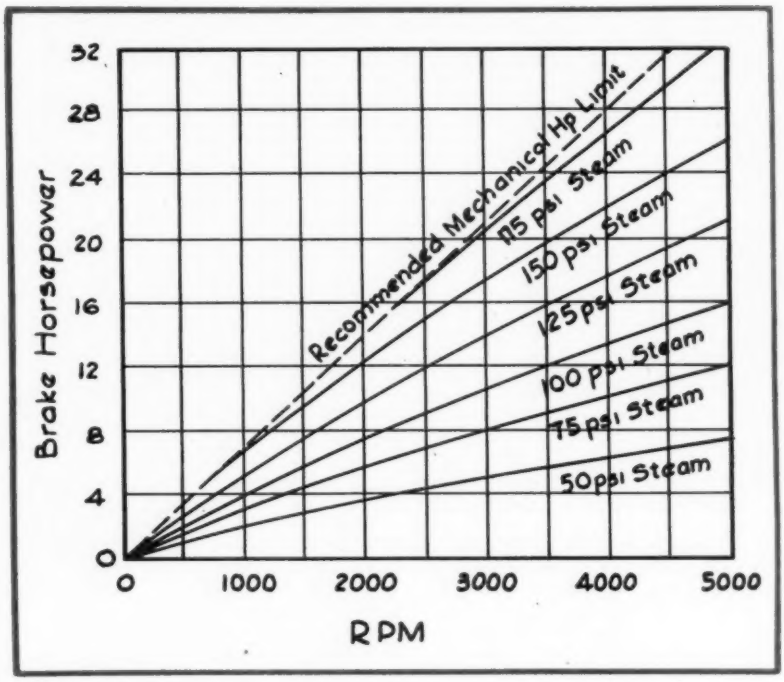


Fig. 1 — Recommended mechanical hp limit chart — rpm vs brake hp for various steam pressure relations

Cost Variables

Obviously more pounds of steam will have to be generated (or superheat employed) to make up for the lower amount of heat per pound of steam in the turbine exhaust. When the extra cost of larger boiler units are taken into account and extra charges made for superheating equip-

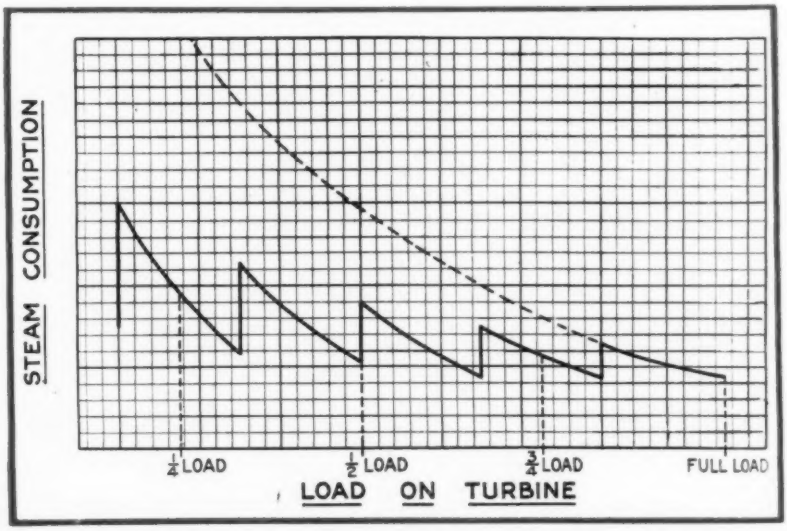


Fig. 2 — On sustained light loads, power output is improved by increasing nozzle velocity with hand valves

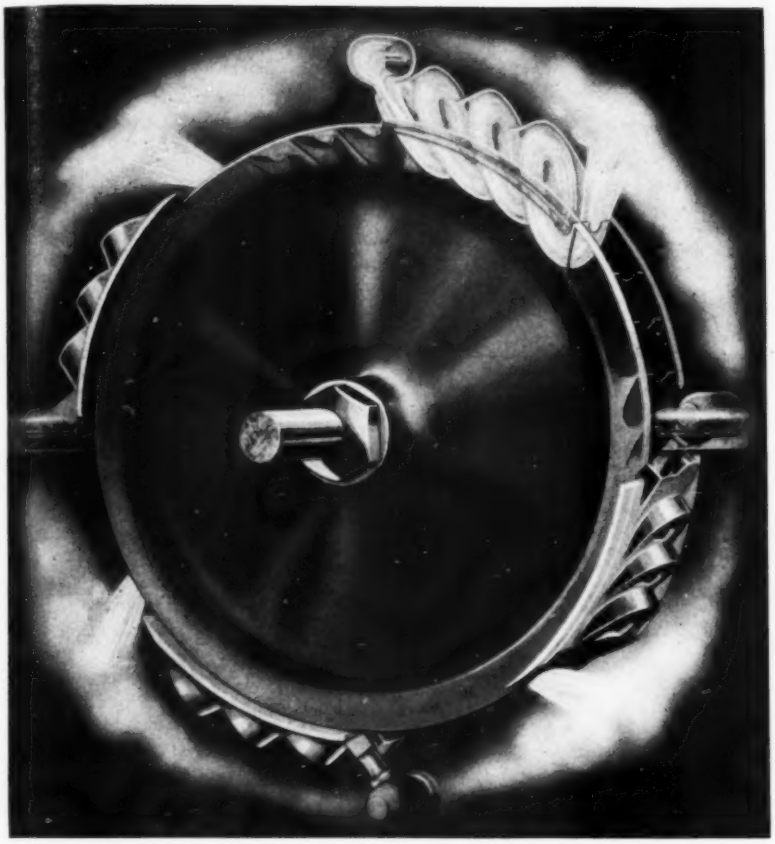


Fig. 3—Single turbine wheel can gain multiple-stage effect by incorporating a method of mechanical steam re-entry

ment, capital charges per kwhr generating capacity seem to reach a minimum near the 400 psi class. At about this pressure the maximum heat for power is made available per dollar of boiler investment. Other variables such as higher exhaust pressure desired, initial process temperatures, and the possibility that more than one exhaust pressure might be needed keep the 400 psi boiler from being the ideal pressure for all cases.

With fuel at $5.00 per ton, operating costs should approximate 2 mils per kwhr generated, in which case power could be had as a by-product for a total of less than $.005 per kwhr based on the figures assumed for Table I.

Turbine drives are particularly adaptable to by-product power generation as the exhaust flow is steady, governing action is rapid, and the high-rotative speeds permits installing physically small units to handle heavy loads. They are also easily adapted to high back pressure service.

In connection with by-product power generation, the prime mover's efficiency is not important except as an indication of the machine size. Heat not given up to the wheel will be carried in the steam at the exhaust and is recovered in process. Loss of capacity from lower efficiency is also of relatively small consequence. Heat losses from radiation and leakage are of greater concern because such losses are not recoverable.

A comparison of water rates of small steam engines and non-condensing turbines show little advantage to either unit. Gear reducer sets may become a little noisy and might add considerable to costs, and for this reason turbines do not necessarily make the best drive for speeds under 300 rpm. Physical size, over-all cost, and water rates of turbines are considerably reduced if the wheel speeds can be 3600 to 5000 rpm instead of 1200 to 1800 rpm. This is shown graphically in Fig 1.

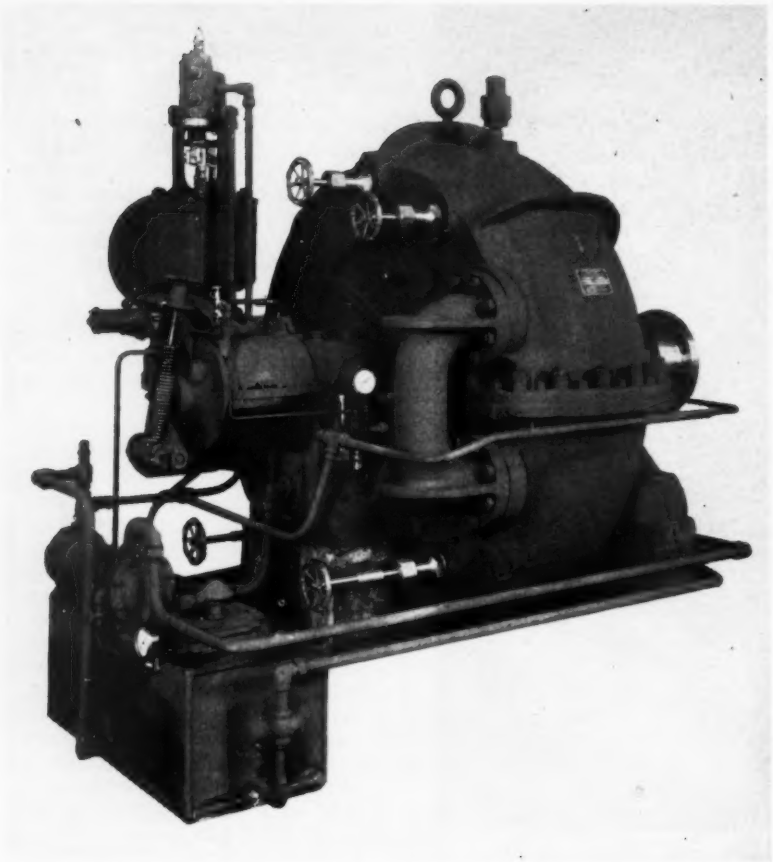
In turbines of the impulse or velocity type, efficiency and power are highest when the bucket or rim speed is roughly ½ of the steam nozzle velocity. Thus, partial load water rates go up rapidly if a straight throttling governor is employed for control. To keep the cost of smaller units low, most small turbine governors are designed to control total flow to all nozzles from a single valve, but hand valves are often provided to close individual nozzles. On sustained light load runs, an increase of power output from a given available steam flow can be obtained by shutting off some nozzles so as to increase steam velocity through the remainder. See Fig 2.

To obtain the maximum power per lb of steam requires more than one stage or wheel, but turbine wheels are usually the most expensive single component of the turbine. To gain the

TABLE I

Sample Comparison of Power Costs at Various Throttle Conditions That Will Give Exhaust Steam Equivalent to 70,000 lb/hr at 150 psi Sat. Temp.

Throttle Pres.	200 Psig		400 Psig		600 Psig	
Throttle Temp.	Sat.	550° TT	Sat.	600° TT	Sat.	800° TT
Throttle Btu/lb	1203	1286	1205	1306	1203	1406
Exhaust Btu/lb	1180	1255	1169	1259	1153	1330
Exhaust % Moisture	1.8	100° SH	3.0%	120° SH	4.8%	250° SH
Boiler Output Lb per Hr.	71,000	66,700	71,750	66,000	72,720	61,500
Kw Hr Possible at 50% Eff.	475	600	750	905	1060	1360
Added Cost of Equip.	$30,000	$35,000	$ 43,500	$67,000	$76,000	$115,000
Cap. Cost Kw/Hr Based on 10% and 8000 hrs/yr of Operation	$ .0008	$.00077	$.000727	$.00092	$ .0009	$ .00106
Cap. Cost Kw/hr Based on 10% and 4000 hrs/yr of Operation	$ .0016	$.00154	$ .00143	$ .0018	$ .0018	$ .00212



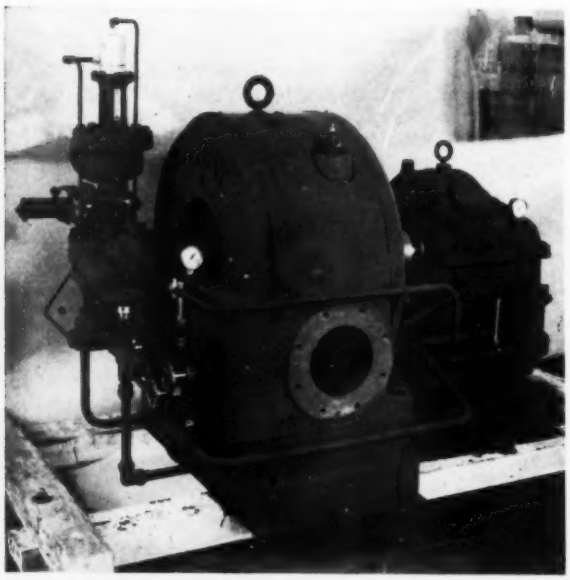
This is a 925 hp turbine designed for 400 psi/100°F steam and 165 psi back pressure, which will operate exhausting equipment satisfactorily. It is the type used in process plants with new 400 psi boilers. A turbine such as this one is suitable to drive a generator or any other type of power-plant unit

effect of multiple staging without adding more wheels, various forms of reentry have been designed. Two of the more prominent methods are shown in Fig 3.

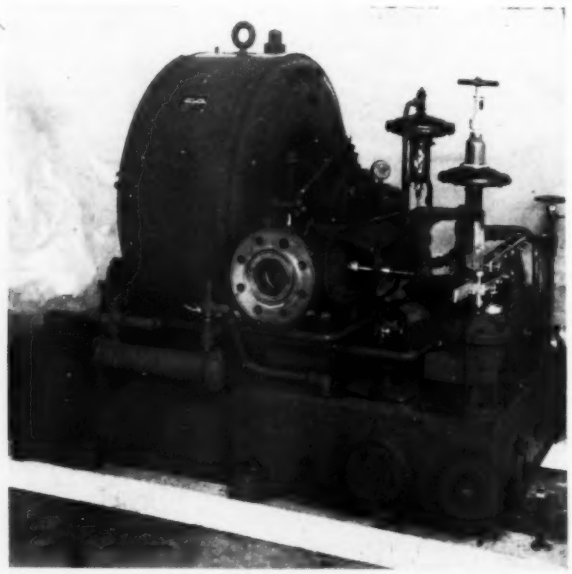
Sometimes three or more process steam pressures are desired. A single turbine designed to exhaust or bleed at more than one pressure requires multiple stages. Thus, in most cases the purchase of two or more small single wheel units for direct mechanical drives might be more economical than the multistage - multiple bleed single turbo-generator. Manufacturers can supply a single spindle turbine all in one case that will not only bleed fixed or variable quantities at 4 or more points but also units that are designed to admit lower pressure steam into the lower stages. These latter are called mixed-flow turbines and have automatic governing on both high and low pressure steam supplies.

By utilizing mixed-flow-condensing turbines almost any type of industrial steam power ratio can be balanced to give peak return from fuel dollar.

Steam auxiliaries require additional piping, traps, insulation, valves, hangers, and space. Private power generation adds responsibility to some production supervisor and additional skilled personnel is required. But, assuming management has the capital, is willing to take on the responsibility, and space is not at a premium, by-product power generation or mechanical drives powered by steam turbines should pay out in less than 5 years.



Turbine-gear unit is capable of developing 250 hp. The turbine operates at 4800 rpm, and the gear reduces the speed to 1445 rpm. Steam conditions are, 425 psi—650° TT—17 psi back pressure. The turbine can be equipped with a variable-speed governor to meet load requirements



Single-stage 900 hp turbine, operating at 3500 rpm, is designed for 640 psi initial pressure, 690°F total temperature, and 125 psi back pressure. This turbine has a variable-speed oil relay governor, which is controlled by pump discharge pressure. Unit is applicable to pumps

RETAINING POWER EFFICIENCY AT VARIABLE SPEEDS

There are distinct advantages in hydraulic transmission if speed changes can be controlled. Good methods are mechanical and electrical speed changers that adjust variable speeds without loss of power transmission efficiency

R. A. MOLLER, Associate Editor

ADVANTAGES of the hydraulic transmission of automobiles have been adopted by the materials handling engineer, as a coupling where heavy inertia loads are involved, for crushers, heavy duty conveyors, and elevators. A distinct advantage is obtained if the load can be automatically picked up after the motor has attained speed, and automatically released in the event of a jam.

Motor acceleration is shown in Fig 1 indicating also the connected machine characteristics. The motor attains about 70% full-load speed before the coupling functions to start the load and continues to accelerate as the load builds up. Of course, there is a slight running slip, indicated by the difference between full-load motor curve and speed curve of the driven machine, but this is of no practical consequence.

Relationship between output torque, current, and speed of a squirrel cage motor driving through a hydraulic clutch and when direct connected is indicated in Fig 2. Nearly maximum torque starts the load while starting current drops quickly to normal value in the hydraulic clutch. The curve marked "motor current" illustrates what happens when the motor is direct connected. A fluid coupling (Fig 3) may be an integral part of the motor frame and is mounted on a rigid base that supports the usual helicoid speed reduction unit.

When a variable speed is required several well-known mechanical speed changers are available, with ranges usually from 1:1 up to 6:1, or less. General operating principles are the same — increasing or decreasing the driving member diameter while decreasing or increasing the driven member. A compact variable speed drive for a screw conveyor (Fig 4) usually has the motor bolted directly to the speed changer frame. The speed changer in turn is connected to a worm gear speed reducer on the shaft of the conveyor, all mounted on a rigid steel or cast iron bed plate. The speed change handwheel controller is at the upper left but, if desired, remote control is available.

Electrical speed changers provide far wider range than is possible with a mechanical unit. One popular type transmits power through an eddy-current clutch with no mechanical contact between the driving and driven members. A rectifier furnishes d-c to energize the field and create intense flux concentration at the clutch field pole face, and a constant torque between driving and driven shafts is provided. Speed regulation is attained with about the same accuracy as that attained through a mechanical speed changer, but with almost unlimited range. The rotor of the a-c motor is mounted on a quill supported by two anti-friction shaft bearings. The clutch armature is rigidly attached to the end of the quill and forms the constant speed driving member of the clutch, which receives d-c excitation through two collector rings. Complete field assembly is keyed to the through shaft for connection to the load. Magnetic fields produced by eddy currents in the clutch armature react with the flux in the field. A torque is produced tending to pull the two members into step, and by varying excitation, any desired slip is produced. If excitation is constant, torque increases as slip increases. By varying excitation, the clutch slip at loads within the rating may be adjusted and will be maintained. The

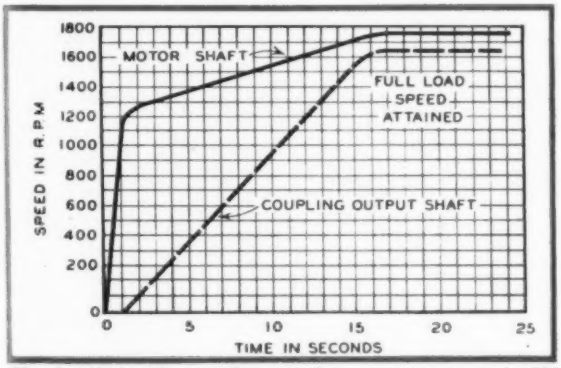


Fig. 1—Hydraulic coupling permits a motor to attain 70% full-load speed, before it functions to pick up the load

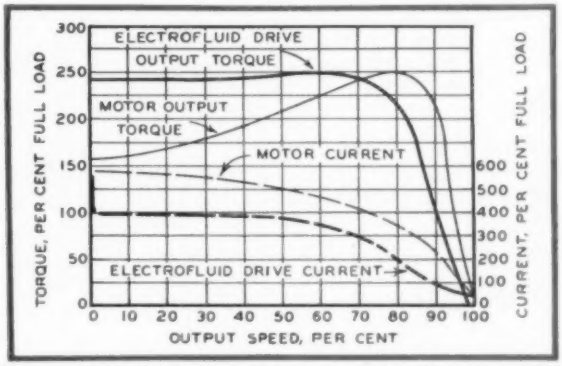
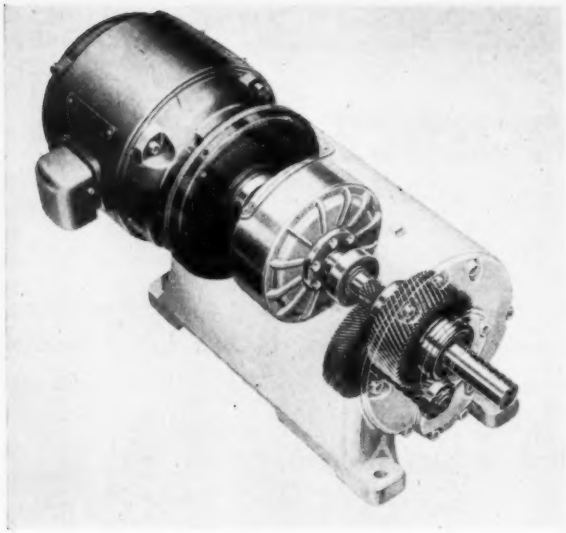


Fig. 2—Typical characteristic curves showing the relationship of a squirrel-cage motor and hydraulic coupling



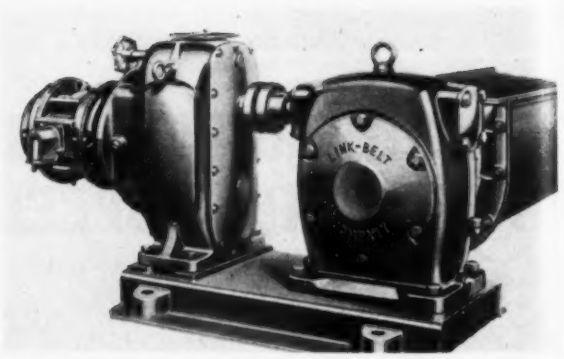


Fig. 3—Fluid coupling (above) can be integral part of motor and reducer arrangement mounted upon a rigid base

Fig. 4—This variable-speed screw conveyor drive can be direct connected by means of flexible coupling equipment

eddy-current clutch, when fully excited, is capable of developing two to four times normal full-load motor torque. Clutch starting torque, attained by increasing excitation while the motor is running at full speed, is quite equal to the pull-out torque of the motor (200 to 250% of the normal full-load torque). A governor automatically controls the excitation source to maintain speed substantially constant under varying load conditions.

Electronic Rectifiers

Electronic-tube rectifiers make possible the wide speed range of d-c motors from an alternate-current source. This device (Fig 5) has four elements: d-c motor, electronic panel, power transformer, and control station. A speed range up to 20:1 is easily obtainable by varying the voltages applied to the motor armature and up to 100:1 by varying also the field strength. Entire range of speed-change is secured by manipulating one potentiometer dial handle just below the start and stop button. The dial is pre-set for any desired speed. When the start button is pressed the motor accelerates to that speed quickly, because armature current is held at maximum safe value and the motor always starts at full field voltage. If the pre-set speed is in the weak range of the motor, the field voltage is automatically reduced as soon as the a-c begins to drop. The electronic limiting circuits prevent motor current from rising above a pre-set value, regardless of motor load. If, however, overload continues, a thermal overload relay takes the motor off the line. Should the load stall the motor, the armature current will still be limited to the pre-set value. Speed can be changed at any time by shifting the dial handle.

When the stop button is pressed, the armature is automatically disconnected from the line and connected across a line resistor, then dynamic braking brings the motor to a smooth stop. Tubes are readily changed and apparently have an average life of three to four years under average working conditions. The control is made for drives ranging from fractional to 25 hp.

Transmission of power to industrial machines involves widely differing considerations. In many cases the machine is started under no load and direct connection to the motor is not objectionable, but other machines have extremely high starting inertia. For example, in a long belt conveyor, especially if the lubricant in the roll bearings has become chilled or after an emergency shutdown while loaded, the starting torque is several times the running torque. Not only is slow acceleration needed for such a problem but engineering skill is required to design the belt to prevent stripping the cover when such heavy pull is applied.

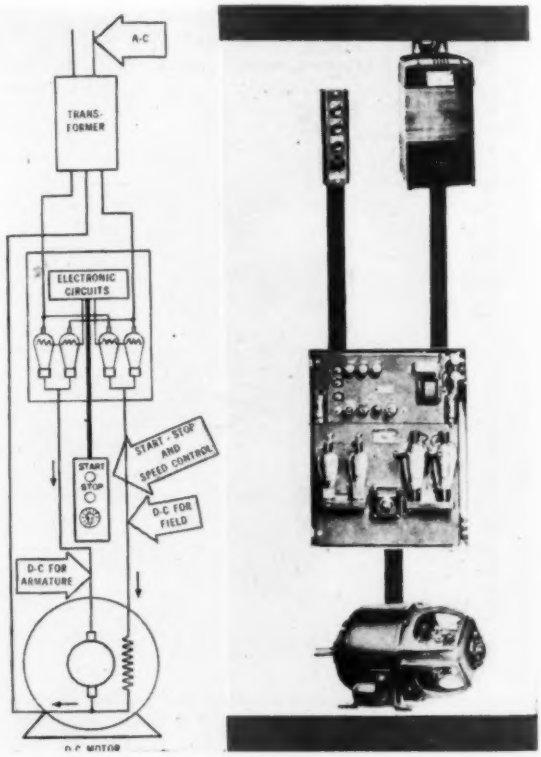


Fig. 5—Electronic controlled d-c motors from an a-c power source will give speed ratios of 20:1. With an armature control, ratios are 100:1

Front view of the creep-testing apparatus. Multiple circuit electronic controls designed by Babcock & Wilcox engineers insure optimum accuracy

NEW LABORATORY STUDIES CREEP AND STRESS-RUPTURE

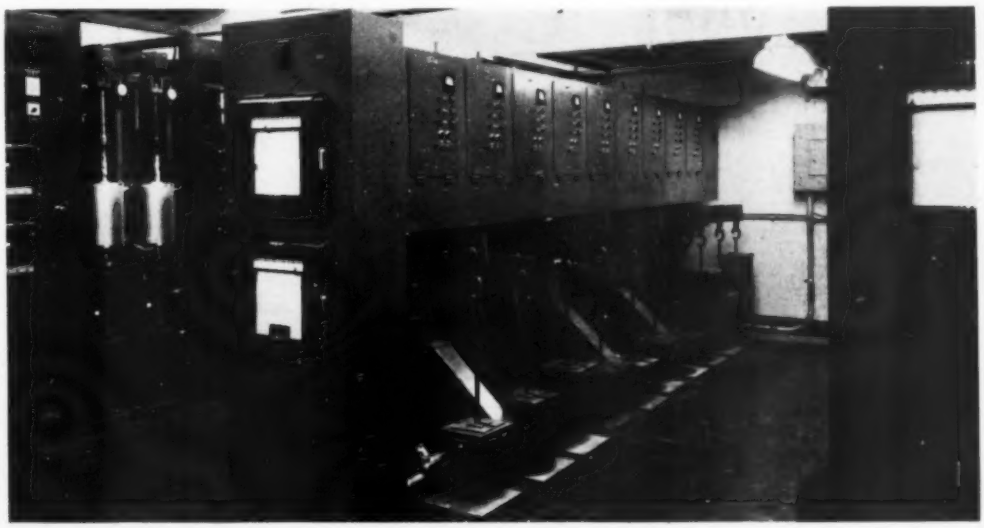
Babcock & Wilcox's new laboratory is set up to operate under ideal working conditions. The temperatures — accurate to 1° plus or minus — can be held for a specimen, while the creep and stress-rupture measurements can be made to 0.00001 in.

PERHAPS the earliest investigation of creep and stress-rupture on an extensive scale was establishment by The Babcock & Wilcox Company and The Babcock & Wilcox Tube Company in 1926. At that time a joint fellowship was set up at the Massachusetts Institute of Technology, under the direction of Professor F. H. Norton.

In recent months the original apparatus, designed by Prof. Norton and B & W engineers at M.I.T., was moved to The Babcock & Wilcox Company's new research and development laboratory at Alliance, Ohio. Twenty stations, designed for creep tests and usuable for stress-rupture tests, are available. Optimum accuracy will be achieved by multiple-circuit electronic controls, which are actuated by the expansion of the furnace tubes. These controls make possible the holding of temperatures within plus or minus 1° F up to 1550° F.

In running a test, a 10 in. specimen is employed. The precision of the measuring instrument, the extensometer, is six parts in a million and a change of less than 0.00001 in. (10 micro-inches) can be accurately measured.

Daily creep of a specimen varies



A rear view of the apparatus designed for creep tests but usable for stress-rupture tests. The equipment was developed at M.I.T. but has now been moved to the new B&W research and development laboratory, Alliance, Ohio

Front view of the Baldwin-Southwark lever-arm single-station unit that is also used for creep tests. This unit has just been added to the facilities at the B & W Alliance laboratory

with load, temperature, and characteristics of the material. This extension may be as low as five micro-in. per day (the smallest division on a standard machinists' micrometer caliper is 1,000 micro-inches) or a maximum as high as 250 micro-in. per day.

Stress-Rupture Tests

Overloaded creep tests—stress-rupture—are continued to actual failure, and the time required to rupture the specimen at a given stress and temperature is then determined. Test bars are subjected, in series, to static stresses of various magnitudes at a selected temperature level. Stresses applied are much greater than those employed for creep tests.

Creep and stress-rupture data are of considerable value to manufacturers of steam-generating equipment in connection with rolled-in joints, superheater tubes, headers, baffles, and fittings. Turbine builders are also vitally interested. Alloys for turbine wheel forgings and blades must be selected so that binding will not occur at operating temperatures and pressures. Furthermore knowledge of metal properties is important because of safety and determining probable service life.

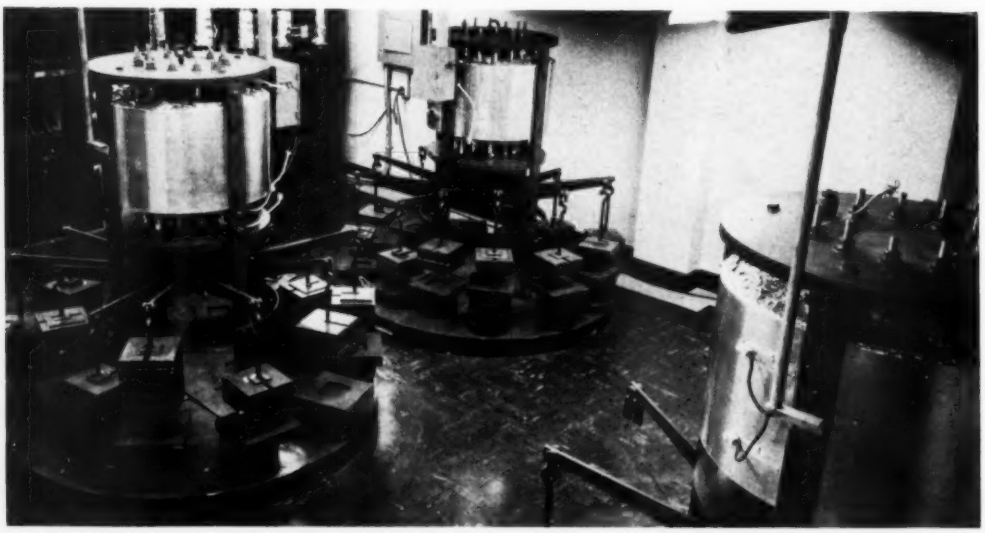
To prevent expansion of the testing unit framework, the room is maintained at a constant temperature.

Additional facilities at Alliance have been provided by purchasing 16 single-station, lever-arm creep-testing machines. Maximum temperature of 1800° F can be obtained, and controls will hold temperatures to plus or minus 2° F. Gage length of the test specimen is 3.0 in. rather than 10 in., and the accuracy of the reading is approximately fifty parts in a million. These machines are also suitable for stress-rupture test. Specimem temperatures, at each of the 20 stations, are recorded continuously on a strip-chart.

Stress-rupture characteristics of metals will be studied in 4 twelve-station units. The furnaces are of annular design, and each contains twelve circular chambers for specimens. Temperature of each specimen is recorded continuously, and when a specimen ruptures the change in temperature records the time of rupture. Excellent temperature uniformity exists, and a furnace control of plus or minus 3° F up to 1500° F is regularly obtained. Generally, each unit is operated at a different temperature level.

Total simultaneous capacity of the laboratory is 36 creep tests, 48 stress-rupture tests, or 84 stress-rupture tests.

Acknowledgement is made to The Babcock & Wilcox Company for information contained in this article.



Twelve-station machines of the type shown here were designed and made at the new laboratory to conduct studies of stress-rupture characteristics of all types of metal

CHEMICAL DETERIORATION OF COOLING TOWER LUMBER

High concentrations of normal sodium carbonate and associated high pH is the primary cause of delignification. Recommended preventive practices herein presented are based on examination of 500 cooling towers and extensive tests of three types of lumber

C. L. BLOHM, Assistant Director of Research and Development, and H. D. FRAZIER, Senior Research Chemical Engineer, Fluor Corp., Ltd.

EMPLOYMENT of cooling towers in the process industries for the dissipation of mass heat loads has been of general practice for many years, and this practice has been quite satisfactory from the standpoints of operation and economic considerations. However, such towers, when constructed of wood, are subject to certain types of deterioration, among which are chemical and bacterial attack, attack by other living organisms such as the Teredo and similar wood-chewing insects, and fouling of the structure by algeal growths. This article will discuss chemical deterioration as involved in the failure known as "delignification".

Very briefly, wood consists structurally of a series of hollow cells surrounded by the cell walls, adjacent cell walls having a common medial layer known as the middle lamella*. This common layer serves to cement the cells together and probably is largely responsible for the strength characteristics. The cell walls themselves consist of two generally distinct kinds of material, cellulose and lignin, and the cell cavity contains the so-called extraneous materials of wood, which include sugars, salts, oils and resins. The latter probably have little bearing on the subject under discussion. Rather extensive investigations into the composition of the cell wall and middle lamella indicate that the latter consists to a large extent of what is commonly classified as lignin.

While the structure of lignin itself has never been very thoroughly clarified, it is known to consist of certain general chemical groups and is classified analytically as the wood material soluble in strong caustic or bisulfite solutions as contrasted with the cellulose which is soluble in acid solutions. In wood chemistry the term "delignification" is meant to describe the removal of alkali or bisulfite soluble matter, and, since such material is that which is largely responsible for the strength of the wood, it is probably proper to apply this terminology to the structural failure of cooling tower lumber resulting from dissolution of lignin. However, the process as it operates in destroying a cooling tower is probably more complex than the simple procedure used in making wood analyses, since there are mechanical and other effects involved which will be discused below.

Effect of Delignification

Delignification in cooling towers results finally in leaving the wood residue as a fibrous cellular structure of extremely low strength and in extreme cases this residue is probably largely cellulose. In one observed instance of cooling tower failure, large quantities of pure white short cellulose fibre were recovered from completely plugged pump and basin weir screens after severe and rapid delignification had occurred.

In such advanced cases, the fact that the loose cellular structure will not hold nails or properly support other fastenings precludes almost any reasonable repair method other than complete replacement of the failed members. Thus, it may be seen that in installations where delignification can occur in a cooling tower, the resultant damage is of considerable concern to the tower owner, since expense is incurred not only in repair of the damage, but may in addition result from disruption of plant operation.

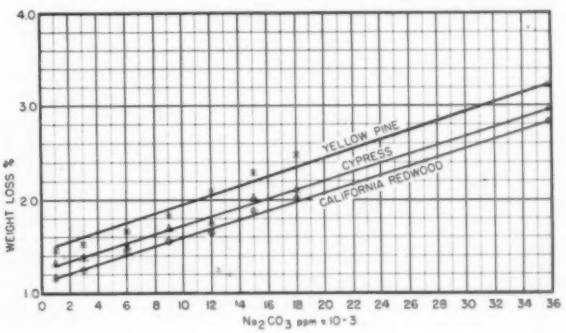
The above introduction should not imply that the phenomenon of delignification occurs in all cooling towers, but the occurrence is of sufficient frequency to warrant the interest of all persons concerned with the use of such equipment.

In the light of the above considerations, information of considerable value could be obtained from investigation into the causative factors involved in delignification and into means for inhibiting or completely preventing such occurrence. To this end a survey and laboratory investigation** were conducted in an attempt to evaluate some of the involved factors.

The survey consisted of the examination of over 500 cooling towers, covering an area of approximately 2 million square miles in the Pacific Coast and Mid-Continent regions. While it was not possible in many cases to obtain sufficient long-time data to enable accurate conclusions to be drawn, complete reports were obtained on a total of 158 towers, and, in general, the remaining towers indicated the same basic factors as were evidenced in the 158 recorded reports.

A survey of the data accumulated indicated the possibility that the presence of sodium carbonate in the water might be a principal factor in effecting delignification.

On the basis of the survey findings, laboratory experiments were initiated



The weight loss of wood in concentrations of Na_2CO_3 after immersion for 60 days. Data are for three types of wood commonly used in the construction of cooling towers

Table I—Effect of Various Solutions on Cooling Tower Lumber

Sample	Solution	pH	% Loss in weight: Redwood	% Loss in weight: Cypress	% Loss in weight: Yellow Pine
1	1000 ppm Na_2CO_3	10.94	1.16	1.32	1.46
2	3000 ppm Na_2CO_3	10.94	1.24	1.38	1.53
3	6000 ppm Na_2CO_3	10.95	1.46	1.52	1.66
4	9000 ppm Na_2CO_3	10.95	1.56	1.69	1.84
5	12000 ppm Na_2CO_3	10.95	1.64	1.76	2.09
6	15000 ppm Na_2CO_3	10.95	1.89	2.02	2.29
7	18000 ppm Na_2CO_3	10.95	2.02	2.11	2.48
8	36000 ppm Na_2CO_3	10.95	2.84	2.97	3.23
9	36000 ppm NaCl	7.49	0.21	0.22	0.42
10	36000 ppm Na_2SO_4	7.51	0.18	0.17	0.39
11	36000 ppm $CaSO_4$ $MgSO_4$	7.2	0.15	0.16	0.39
12	36000 ppm NaCl $CaSO_4$ $MgSO_4$	7.4	0.11	0.09	0.38
13	24000 ppm HaCl $CaSO_4$ plus $MgSO_4$ H_2SO_4	5.01	1.22	1.20	1.99
14	H_2O plus H_2SO_4	4.50	1.48	1.53	2.06
15	24000 ppm mixed salts plus H_2SO_4	7.20	0.08	0.09	0.32

to provide further evidence. These experiments were conducted on three typs of wood commonly employed in cooling tower construction: California Redwood, Cypress and Yellow Pine.

Samples of each were prepared of approximately the same size and weight and these were dried in an oven at 95° C. for 48 hours before final weighing. The specimens were then placed in the test solutions and allowed to steep for sixty days, after which the specimens were removed and thoroughly washed in distilled water, the washings being returned to the original solutions. Finally, the samples were again dried at 95° C. for 48 hours and weighed, and the weight change was recorded as percent loss of the original weight. The test solutions were analyzed for total extract content and within the limits of error of the experiments the weights of the extracts equaled the loss in weight of the test specimens. Table I and the graph on page 105 give the results obtained.

In order to test the presumption that sodium carbonate was a principal causative factor in delignification, the first eight test solutions used contained increasing amounts of this salt and no other. Since, in concentrations of 1,000 ppm and greater, the pH of such solutions is essentially constant, this series of tests gives a direct correlation between weight loss and the effect of sodium carbonate concentrations independent of pH.

Results of Tests

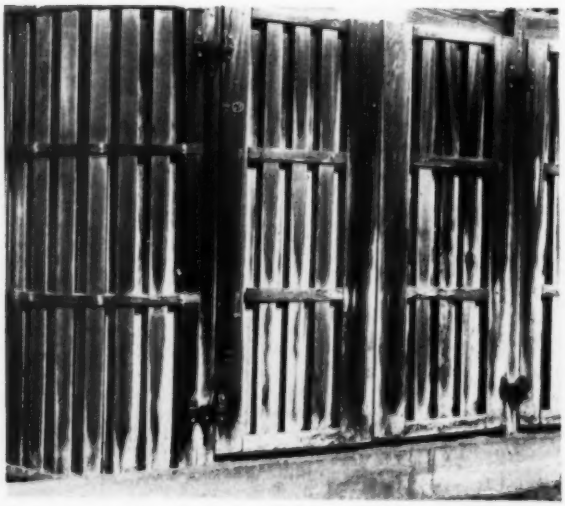
Inspection of the tabulated data and the curves herein indicates that the loss in weight is approximately linear with increasing sodium carbonate concentrations above 1,000 ppm. Unfortunately, distilled water brought to the same pH, but with zero sodium carbonate content, was not utilized for a comparative base; therefore, one cannot predict the shape of the loss curve between the origin and 1,000 ppm abscissa.

Further inspection of the tabulated data indicates that high concentrations of neutral salts have little effect in promoting delignification as long as the pH of the solution is kept between 7.0 and 7.5. Under acid conditions there is some wood destruction which cannot be classified as delignification but becomes appreciable as the pH drops to 5.0 or lower.

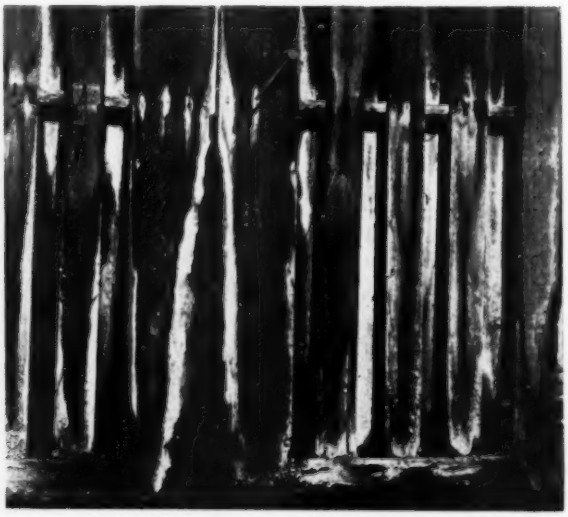
Finally, inspection of the experimental data indicates that California Redwood has somewhat greater resistance to delignification than the other woods employed.

While it is unlikely that one would ordinarily encounter salt concentrations in cooling waters as high as 36,000 ppm, it is possible to attain such concentrations in localized areas

Shed doors of cooling tower in initial stages of delignification. Note accumulated salts and feathering of batts



Further progress of delignification of coil shed doors. Note an increase in salts accumulation and exfoliation



where salts have accumulated due to evaporation. Examination of the reported data on the inspected towers indicates that delignification is excessive in such localized areas and, in general, considerably greater than in the tower areas which are continuously washed by the circulating water. In the light of this observation, it is indicated that prevention of such salt accumulation by periodic washing of the affected areas would contribute considerably to prolonged tower life, and this would be true even in installations in which the circulating water is deleterious.

Effects of pH

Since the tests conducted with the sodium carbonate solutions were all at essentially the same pH, it is not possible to predict the effect of pH on the rate of delignification, although increasing pH could be used as a qualitative index of possible difficulty; however, the wood chemistry involved is somewhat complex. Although caustic solutions are commonly employed for effecting delignification of wood in the preparation of paper pulp and other operations, these solutions are usually fairly concentrated.

Redwood tanks have been employed in several instances for the storage of dilute caustic solutions in concentrations up to 3% for periods of several years without any noticeable deterioration. The pH of such a solution would be between 13 and 14, so it is seen that pH alone is not a criterion of delignification.

On the other hand, concentrated sodium carbonate solutions are not well handled in Redwood tanks, and thus it is apparent that sodium carbonate seems to have a specific action in delignification processes, since the pH of even a concentrated sodium carbonate solution cannot exceed about 11.5. Nevertheless, in cooling tower operation, high pH in the water is nearly always due to accumulation of sodium carbonate, since free hydroxide is seldom encountered; therefore, it is possible to utilize the simple measurement of pH in the water as a qualitative indication of probable delignification resulting from carbonate accumulation.

Finally, there is undoubtedly a further contributing factor in the areas in which salt encrustation is allowed to occur; any liquid phase in contact with such encrusted salts is necessarily saturated and such saturated solutions will tend to soak into the wood to some extent. On subsequent drying of the area involved, the salts are left behind and may decrepitate due to loss of water of hydration, resulting in rupture of the cell membranes, or, on repeated rehydration, may swell, again causing cell rupture.

Either of these occurrences results in a type of exfoliation which gives the wood a rough, stringy appearance, and, furthermore, continually presents fresh surface for either repetition of the same occurrences or dissolution of more lignin by concentrated sodium carbonate solution. In any event, however, the attack appears to be considerably increased in the presence of sodium carbonate as contrasted with the mechanical action due only to the accumulation of neutral salts.

Of all the salts commonly occurring in cooling tower waters, sodium carbonate is unusual in its ability to cause this type of mechanical destruction in that there are three different hydrate forms in addition to the anhydrous form, a complex of sodium carbonate and sodium bicarbonate and water, and, in addition, the possible conversion to sodium bicarbonate. This makes a total of six relatively common forms, all of which have different crystal structures and any one of which may be converted to any other by changes in temperature and available water.

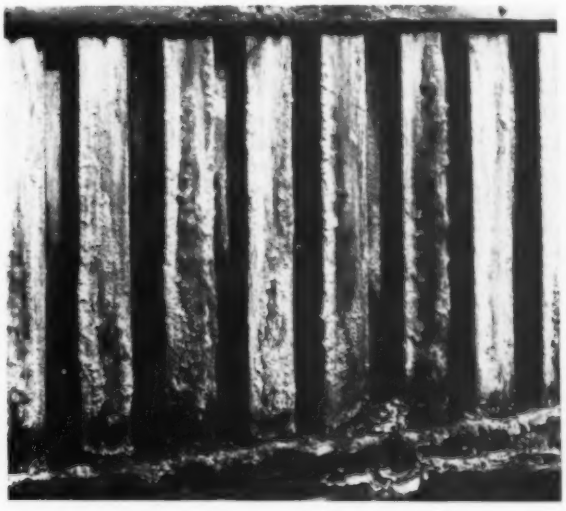
Importance of pH Control

Since the conclusions drawn above indicate the undesirability of sodium carbonate in cooling water towers, the most obvious recommendation would be the elimination of this salt from the system. Investigation has indicated that sodium bicarbonate itself has little effect in promoting delignification; however, bicarbonate ion is readily converted to the normal carbonate due to the increased temperature of the influent circulating water and its aeration. For this reason it is obvious that pH control is of extreme importance in carbonate hard waters, since the carbonate to bicarbonate ratio increases with increasing pH and at values of 9 or higher most of the hardness is in the form of normal carbonate.

This means then that it is not necessary to remove the carbonate completely by means of ion exchange or other treatment, but it is necessary to maintain the carbonate in the bicarbonate form, a requirement that is satisfied by keeping the pH of the water between 7.0 and 7.5. Sodium zeolite treatment of carbonate hard circulating waters may lead to rather high concentrations of sodium carbonate and if such a treating method is used it is imperative that proper pH control be main-

Serious destruction of batting with heavy salt accumulations. Also, note extensive feathering and exfoliation

Advanced stages of delignification of aerator structure, with total destruction of batts in bottom half



Drip panels and aerators shown here are in a dangerous state of destruction by delignification. Here, small forces will break the remaining wood

tained as otherwise sodium carbonate concentrations can easily become excessive.

Since it has been pointed out that the presence of neutral salts in the water does not contribute appreciably to delignification, other treating methods probably can be used with reasonable safety provided again, however, that pH is properly controlled. Since treating of the water is employed primarily for the protection of mechanical equipment, it is unlikely in most cases that pH of less than 7.0 will be encountered, since acid waters in general are not suitable for use in contact with most structural metals. However, it is realized in some instances that inhibited waters of pH as low as 6 are sometimes used in circulating systems. This practice is probably reasonably safe although, in general, it would be well to keep the cooling tower water pH value greater than 6.5.

One rather special incident of apparent delignification is of some interest. In the operation of this particular tower some waste chlorine was injected into the tower water as a convenient means of disposal, since chlorination is commonly used in any event for algae control. However, the residual chlorine content of this water was allowed to go as high as 60 ppm and under these conditions destruction was quite rapid in the cooling tower decking, although the other conditions of the water, that is, pH and sodium carbonate content, were reasonably satisfactory.

This observation would indicate that excessive chlorine concentrations should be avoided and that in general oxidizing materials should not be permitted to accumulate in any circulating water. In this connection, it might be well to point out that a cooling tower and its circulating water should never be used for disposal of waste materials, except in very special cases. In the event that such a practice must be resorted to, more than routine control should be maintained on such a tower in order to determine the effects of such contaminants. Since, in regions in which water is scarce, it is a sufficiently difficult job to maintain the cooling tower water in proper condition, such difficulties should not be aggravated by the addition of further contaminants.

Preventive Methods

As to the prevention of delignification, the following comments and recommendations may be made. Unfortunately, in many instances a cooling tower is not given nearly as much care and attention as is commonly employed in the maintenance of mechanical equipment, and yet such a tower is an important part of a processing plant and represents a considerable capital investment. The most important means of prolonging tower life is proper control and maintenance, and such care should consist first of control of the water for sodium carbonate content and pH. These two factors are interdependent, however, to a considerable extent, since control of pH between 7.0 and 7.5 automatically limits the normal sodium carbonate content to a low value. Furthermore, as pointed out previously, delignification is nearly always greatest in non-operative sections of the cooling tower which are so located that they undergo alternate wetting and drying with consequent accumulation of salt encrustations.

Five of the illustrations accompanying this article show pictorially the progress of typical delignfication in these non-operative tower sections. Periodic hosing or other cleaning of aerators and structural members would serve in large part to eliminate this factor, and such treatment can be effected while the tower is in operation. In the event of cessation of tower operation as a result of general maintenance or repair shut-downs, inspection of the tower should be made and all sections properly cleaned if necessary.

In a search for other preventive methods, some rather cursory field investigations were made on the use of protective materials. Preliminary results indicated that sections treated with materials which reduce the transfer of sodium carbonate containing water through the wood structure exhibited some increased resistance to delignification. However, the results of these studies were not too conclusive, and they have not been pursued further.

Protective Coatings

In some instances in the past, painting of non-functional members has been employed with some success, provided the painting is properly maintained; but most paints do not stand up too well under the conditions found in cooling tower operation, and have to be renewed at intervals. However, good aluminum paint seems to provide effective protection, requiring only occasional replacement.

If painting is employed, some care must be taken to prevent the accumulation of salt encrustation on the painted areas, since such is quite destructive to these coatings. In a few instances, cooling tower lumber has been impregnated with oil or with other water repellants with some success; however, the practice has certain disadvantages, a specific one of which is to increase fire hazard considerably.

Finally, any such impregnation or coating procedure can only be applied to non-operative sections of the tower, since any attempt to impregnate the distribution decking itself results in such gross alteration of the active evaporative surfaces as to reduce the tower efficiency materially. Furthermore, the use of any water repelling agent will result in channeling of the water flow, an occurrence which directly defeats the purpose for which the tower was originally constructed, since a tower's prime function is to effect good water distribution and adequate air to water contact. Thus, it is seen that while certain means may be taken to prevent delignification of parts of the tower structure, protection of the operating sections can be attained only by suitable control of the circulating water.

In summary, delignification of cooling tower lumber is an active problem of considerable concern to many industries. Investigation has indicated that such delignification is due primarily to high concentrations of normal sodium carbonate in the circulating water and associated high pH. Water control and proper care of operating towers have been recommended as suitable means for preventing or diminishing deterioration of towers due to delignification. However, the whole problem has been very briefly studied or investigated and presents a fertile field for the prosecution of research and the development of means for its solution.

*Hawley, L. F. and Wise, L. E.; The Chemistry of Wood, ACS Monograph (1926).
**Conducted by Moberg Laboratories in Conjunction with The Fluor Corporation.

DEPENDABLE, ECONOMICAL SERVICE OBTAINED FROM UNIT HEATERS

Rooms in this pumping station are heated with four forced warm air units —during shutdown periods—normally heated by operating motors. Inside temperatures are held at 40° to 50° F even in extreme outside conditions

FORCED-convection-type unit heaters installed more than two years ago have given the Well Unit No. 8 pumping station of the City of Madison, Wisconsin dependable and economical service. The heaters are employed during winter months to maintain a 40° to 50° F inside temperature when pump motors are not in operation—mostly between 10 p.m. and 6 a.m. When the pump motors are operating, sufficient heat is generated to maintain desired room temperature.

During a recent three-month winter period, when the pumping station was inoperative, the unit heaters were in service 24 hours daily, seven days per week. Average operating cost was approximately nine dollars per day for the full 28-kw heating load (772 kwh per day at $.012 per kwh).

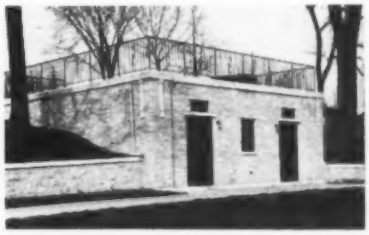
Plant Data

Unit Well No. 8 is a modern, unattended, automatic pumping station supplying chlorinated well water to residential and commercial consumers in the northeast section of Madison. At present, the station is operating 16 to 18 hours daily with a normal load of 2,000,000 gal. However, the station was designed to handle 3,400,000 gal per 24 hours. Built in 1947, when the heaters were installed, the unit is equipped with induction motors, metal-clad switchgear, and unit substation.

Capacity ratings and location of the four suspension-style heaters are: 3-kw unit, repair shop; 5-kw unit, chlorinating and analysis equipment room; 7.5-kw unit, turbine pump motor room; and 12.5-kw unit, booster-pump motor, switchgear, and unit substation room. Each heater is wall mounted so that warm air is circulated throughout the room. The heaters are wired to individual panels and are thermostatically controlled.

"Since the pumping station is built in a public park adjacent to a residential section," said L. A. Smith, the city's Superintendent of Waterworks and Sewerage, "we could not install a conventional type of heating plant because a smoke stack would be undesirable in this area. To meet this situation, we adopted the suspension heater, which solved the problem, as our experience has been that this type of heater is both reliable and economical."

Acknowledgment is made to General Electric Company for the information and illustrations contained herein.



Pumping Station (above) is a modern structure located in one of Madison's Municipal Parks. To eliminate smoke, forced air electric heaters were used

Left—Heaters in corner of pump room maintain a temperature well above freezing when the motors are idle. Station is utilized during peak loads

WATER HARDNESS TESTS SIMPLIFIED

Total water hardness, and the hardness caused by calcium alone, can be measured accurately by method that requires approximately one minute

SEVERAL years ago, Dr. Gerold Schwarzenbach and his associates in Switzerland discovered a simple laboratory method for ascertaining total water hardness. However, it was not readily applicable in the field.

Schwarzenbach's method was confirmed completely as to accuracy and validity through intensive research and test application by Hall Laboratories, Inc., in Pittsburgh, Pa. Additional research enabled this firm to develop a simple test method, convenient for general field use, whereby total water hardness, and the hardness caused by calcium alone, can be determined in approximately one minute.

Designated as the Hagan Total Hardness Test, it is immeasurably superior to the time-honored but time-consuming "soap shaking" method in general use for a century. It involves a simple, direct titration with a distinct color change at the end point, thereby eliminating the possibility of error due to subjective judgment. Also of practical advantage in its application is the fact that interferences, although seldom found, are easily eliminated.

The Hagan Calcium Test is, similarly, a direct titration to a clear-cut color change. It requires no heating, waiting, filtering or estimating. The answer, correct to less than 1 ppm of calcium, is also found in one minute.

Where it is desirable to determine hardness due specifically to magnesium in the water, the operator makes the total hardness test and the calcium test, the difference giving him the magnesium value.

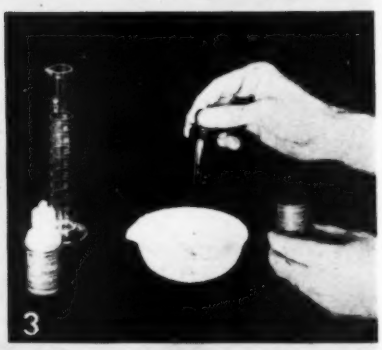
It is reported that both tests have been applied to thousands of samples of water—raw, feed, softened—and have proved to be uniformly accurate.

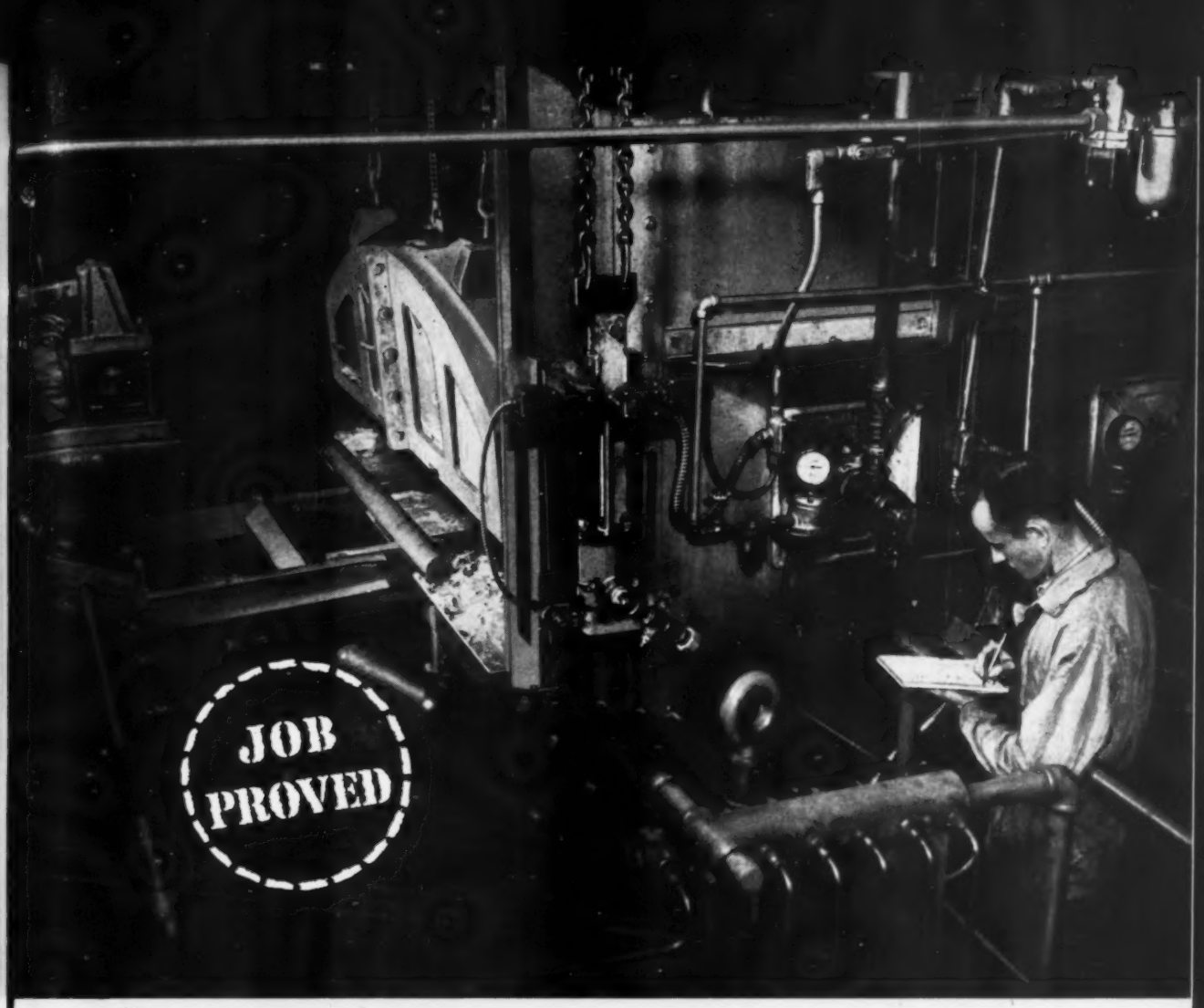
A clear sample of the water to be tested for total hardness is measured into a porcelain dish. A small amount of buffer solution is stirred in to bring the sample to a suitable pH value. The indicating solution then is added and stirred. The sample at this point shows a red color. The final step is addition of the titrating solution, which turns the color to blue. Disappearance of the last trace of reddish tinge marks the end point.

Procedure for hardness due to calcium alone is identical, but with a different buffer solution and indicator, and with final color after titration a violent blue.

All equipment and reagents required for either the Hagan Total Hardness Test of the Hagan Calcium Test is being made available through the Hagan Corp. (parent of Hall Laboratories, Inc.) and its associated firms, Calgon, Inc., and The Buromin Co.

Both hardness tests involve a simple, direct titration with a distinct color change at the end point. For the total hardness test, the step-by-step procedure is illustrated here: (1) Measured sample is poured into porcelain dish. (2) The buffer solution is added. (3) The indicator is added, turning the water red. (4) Titration turns the color from red to bluish at the end point. Procedure for hardness due to calcium alone is identical, but with a different buffer solution and indicator, and with a violent blue after titration





HYDRAULIC SYSTEM KEPT LIKE NEW

Sunvis 916 Effects Substantial Savings; Strainers and Lines Kept Sludge-Free

A copper tubing manufacturer uses an oven with hydraulically operated doors to heat billets to approximately 1550F. The ambient temperatures around the hydraulic mechanism are abnormally high, putting the hydraulic fluid to a severe test of stability. Failure of the system would halt the piercing operation and result in costly delays throughout the plant.

Since the oven was first put in operation, three years ago, the hydraulic fluid has been Sunvis 916. The original charge has never been changed and is still in excellent condition, though the system is tight and requires only a minimum of make-up. Oil lines and strainers are completely free of sludge. Seals and packings are sound. Operations are never interrupted for oil changes or parts maintenance. The company expects to retain the original charge of Sunvis 916 in service indefinitely, effecting large savings in both oil and maintenance costs.

Sunvis 916 is a solvent-refined oil of the highest quality. It is fortified to resist the oxidation and sludging so detrimental to the efficient operation of hydraulic systems. Sunvis 900 Oils are *good for the life of your machines.* For your copy of the illustrated booklet "Sunvis 900 Oils" write Department IP-4.

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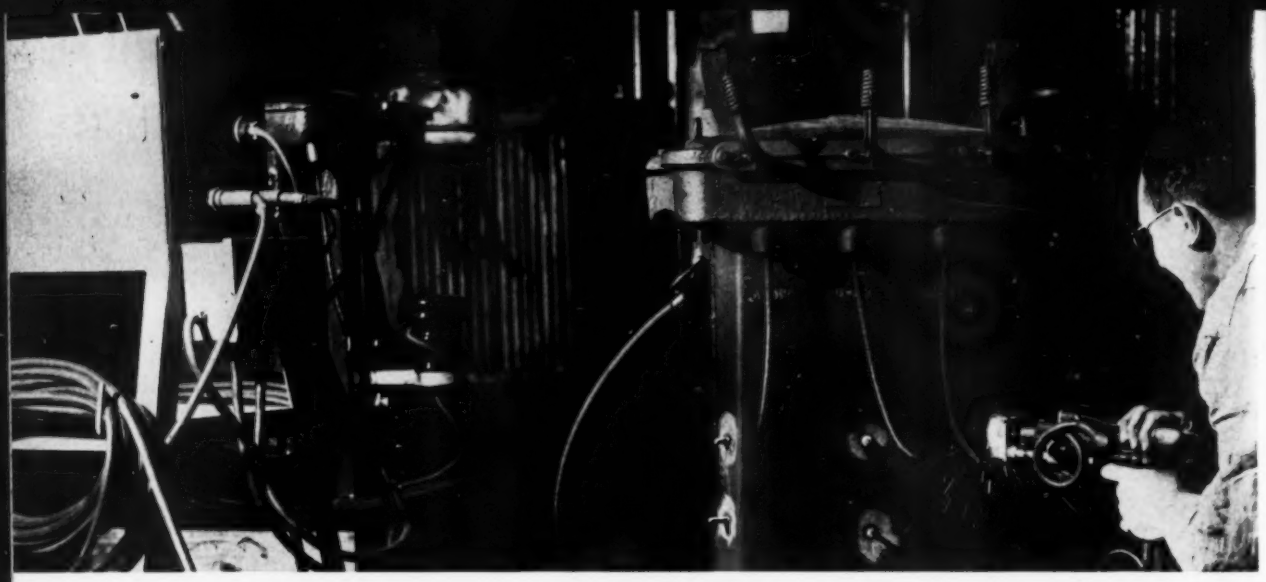


Standard ⅜ in. studs for arrestor brackets being welded to transformer

SHOP WELDING REDUCES FIELD COSTS

Automatic stud welder simplifies assembly of lightning arrestors and brackets to transformers. Method is usuable on steel or iron castings

ONE way to reduce field installation costs is to complete fabrication of units in the factory or shop. A good example of this practice is shown by a mid-western utility company, when they lowered erection costs by more than 25%.

To secure a good contact for lightning arrestors, this company welded studs on all transformer tanks when the units were brought in to the shop for periodical overhaul. Prior to this procedure the arrestors were mounted on the pole cross arms with considerable field expense.

Two standard ⅜ in. studs are end welded to the transformer tank with an automatic stud welding gun, and these studs support the steel arrestor brackets. The lightning arrestors and brackets are bolted to the studs and the entire unit is then raised into position. No extra connection work is required. Three arrestors are mounted on each transformer, with the end welded studs utilized for ground connections when required.

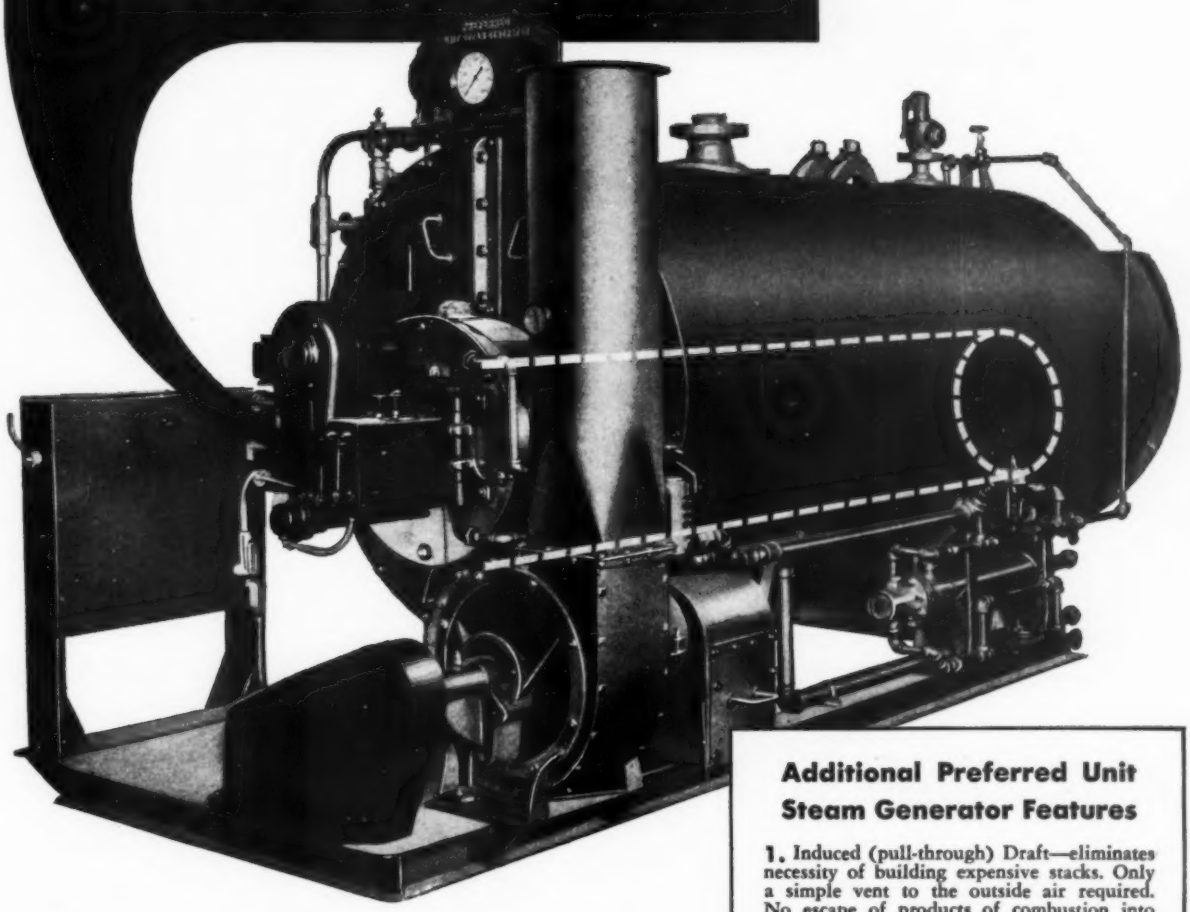
Operation of the stud welding gun requires no special equipment, and power is supplied by a shop d-c welding generator. The stud to be welded is first chucked in the gun, which is then pressed against the housing. When the trigger is pulled, the stud is quickly welded to the tanks.

Stud welding can also be employed for mounting lightning arrestors on cast iron tanks. In such cases, studs are welded to a simple bracket bolted to the tank cover.

Acknowledgment is made to Hill and Knowlton of Cleveland, and Nelson Stud Welding Division, Morton Gregory Corporation for information and illustrations in this article.

Welding gun is controlled by automatic timer and operated by one of the shop's standard-type d-c welding generators. Besides welding studs to steel, it is used for bench production of brackets which serve as lightning supports on the older type cast-iron transformers

Furnace Here Gives You EXTRA BENEFITS



Furnace relatively low in the drum saves you trouble because this location gives extra protection against damage due to low water—allows lower shell water level—and lessens liability of corrosion.

In addition to this "low-furnace" feature, the Preferred unit has both float and electrode type of low water cutoffs, thus affording triple protection against low water. As a result of this triple protection, no case has been reported of a Preferred furnace burning out. Because the furnace is below the point at which most of the steam bubbles form, it is in contact with water all the time . . . there's less possibility of corrosion from oxygen.

Shell water level is low, giving more steam releasing area. Additional steam dome capacity is gained. Foaming and water carry-over are minimized. Delivery of dry steam is assured.

These features are examples of the careful planning Preferred combustion engineers have put into the design of the Preferred Unit Steam Generator. They are examples also of the benefits you will get when you replace your present boiler with a modern Preferred Unit. Write today for complete information.

Additional Preferred Unit Steam Generator Features

1. Induced (pull-through) Draft—eliminates necessity of building expensive stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation—even with Bunker C or No. 6 oil.

3. Preferred Oil Burner—exclusive aid to perfect combustion, built especially for this unit.

4. Four-pass, Down-Draft Gas Travel—results in maximum heat absorption.

5. 80% Minimum Thermal Efficiency—proved and guaranteed.

6. Full Range of Sizes—from 20 to 500 h.p. and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 h.p. with pressures of 15 lbs.

Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.

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PREFERRED UTILITIES MFG. CORP.

Spot News

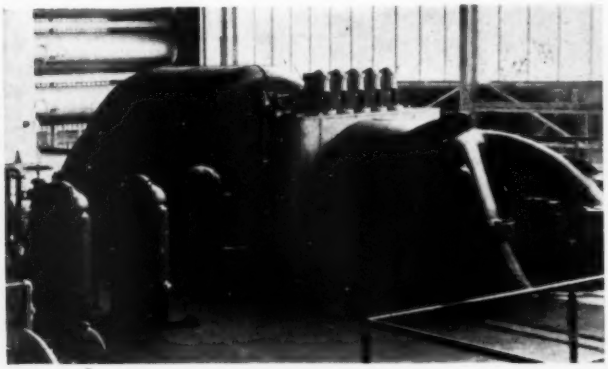
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

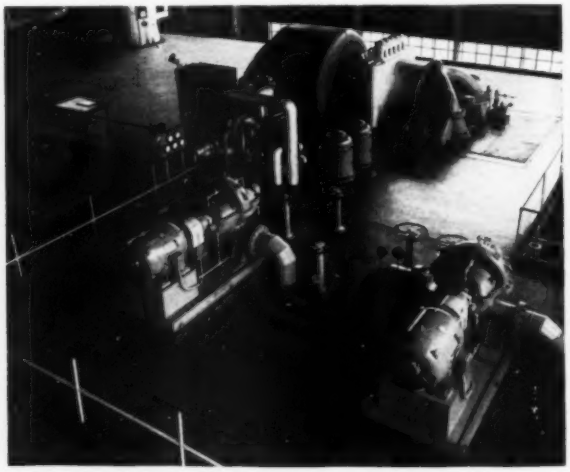
Engineering Talent and Mechanization Aid In Reducing Costs in Small Steam Plants

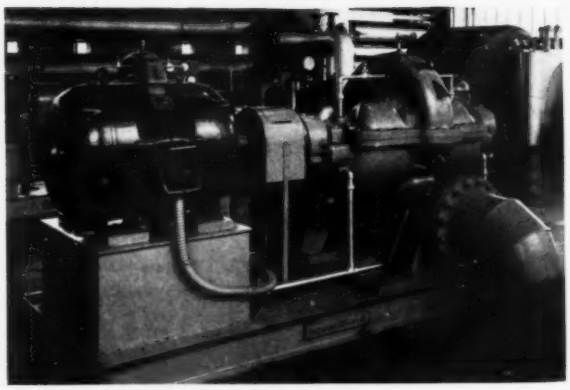
Steam producing costs in the small industrial steam plant, ranging from 150 to 1,500 rated hp are, with few exceptions, excessive, according to Solon E. Friedeberg, vice president of the Franklin Engineering Corp., New York consulting engineers of 45 West 45th Street. Mr. Friedeberg told the Metropolitan Section of The American Society of Mechanical Engineers in a recent address that these plants lack engineering talent and have done little in reducing the amount of labor necessary for operation and maintenance.

"The expansion of an industrial plant almost always requires increased service facilities, of which steam for processing, heating, power or refrigeration is an important factor." he declared. "When such expansion is contemplated, the time is opportune to conduct a complete survey of steam generating capacities and the physical condition of such equipment. The survey must also cover existing steam requirements and the increase of steam load that will be imposed on the plant must be determined accurately.

"The development of any plan for boiler plant improvement will require information as to existing steam generation and the cost to produce it. The steam generated should be measured. The cost of such equipment is usually less than 1% of an annual fuel bill. A record of fuel used should also be kept. Fuel-oil and gas can be readily metered. With a little ingenuity the volume of coal consumed can be recorded, converted to pounds and checked periodically against invoices or bills of lading. Knowledge as to the quantity of steam generated per pound of fuel consumed, together with the calorific value of the fuel used, the steam







THERE'LL BE NO "NEXT TIME"

Reversing the usual procedure, the pumps in the upper right photo were placed on the turbine floor, when this new turbo-blower was installed at the Steelton, Pa., plant of the Bethlehem Steel Company. Lower right is a close up view of one pump, while upper left shows an enlargement of the turbo-blower.

Object of the one floor planning was to prevent any cessation of operations because of flooded conditions, such as occurred in the disastrous flood of March 1936. Now, only the condenser is located on the floor below—and no serious damage will result if it is submerged.

The blower, part of the Bethlehem's vast expansion improvement program, furnishes 100,000 cfm of air for blast furnace. It requires 109,500 lb of steam per hour to energize the blower.

pressure and temperature of the feed-water will be sufficient to approximate boiler plant efficiencies.

"Instructing personnel in the proper methods of burning fuel will bring about economies. However, the installation of combustion controls is a definite aid in maintaining such economies, especially where fuel-oil or gas is used. Mechanical means are gradually replacing hand firing in small industrial steam plants. A good stoker installation will effect considerable economy and pay for itself in a reasonable length of time. Plants using coal should also consider coal handling equipment as a means of reducing the amount of labor required to operate the boiler plant."

Mr. Friedeberg said the mechanization of the plants and the consequent elimination of menial labor would attract higher types of personnel as attendants who would not only maintain the plant in better physical condition but would be capable of keeping records of value to management in determining the cost of steam production.

Pittsburgh Steam Company Turns To Oil To Save Office Workers from Shivers

Downtown Pittsburghers shivered in stores and office buildings during the frigid days in early March due to the acute coal shortage. But not for long. They were soon working in more comfortable temperatures as the result of oil conversion.

One million gallons of fuel oil, representing the standby supply of The National Supply Company's Spang-Chalfant Division plants at Etna and Ambridge, Pa., was pumped

from two barges on the Allegheny river through the heart of the Pittsburgh business section. A temporary 3-in. pipeline was erected to feed oil conversion burners at the Allegheny Steam Heating Company's plant, which provides heat for many downtown stores and office buildings.

The barges, each 230 feet long, were anchored on the Allegheny, near the Etna plant of Spang-Chalfant, with reserve supplies of fuel. Officials of the steam heating company said the oil fuel supplemented dwindling coal stocks to keep heating capacity near normal level.

Foundry To Save $4,372 In Annual Heating Costs

For nearly half a century, the Pittsburgh plant of Rosedale Foundry & Machine Company had been heated by hand-fired coke-burning salamanders. Company officials figured the building, with its uninsulated metal walls and 48½-ft. high roof, could not be heated economically by any other method. Then they carefully analyzed costs. They found that by installing modern, gas-fired heaters there

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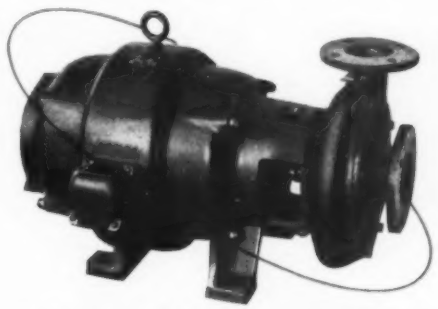
There's a WEINMAN design that best does your pumping job. YOU and your WEINMAN representative should establish this important production link at the earliest opportunity. Together you can put all of your pumping operations on a paying basis. Write, wire or 'phone.

GENERAL SERVICE UNIPUMP



Because of its compact design the WEINMAN Unipump is extremely useful where installation space is limited. It is sturdily built and works against heads up to 500 feet at economical cost. Sizes up to 1000 G.P.M.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

286 Spruce Street • Columbus 8 • Ohio

To select the proper drive for any type of service

GET your copies of the latest Cleveland catalogs for full information on all types and sizes of worm gear speed reducers —including rating tables, dimensional diagrams and data for both standard and fan-cooled units. Ask for Catalog 200 for standard drives and Catalog 300 for Speed-aire (fan-cooled). The Cleveland Worm & Gear Co., 3253 E. 80th St., Cleveland 4, O.

CLEVELAND
Worm Gear
Speed Reducers

For personalized service: Write or phone John E. Millikan Cleveland exch. VUlcan 3-4560

would be an immediate net savings of $402 a year in fuel and labor costs.

In four years, after the new equipment is amortized, the annual savings will amount to $4,372. With four new Dravo "Counterflo" Heaters to replace 39 salamanders in the shop, which has more than 27,000 square feet of floor space, uniformly comfortable temperatures for employes have been

provided. Sulphurous fumes and smoke from salamanders no longer cause discomfort. More floor space is usable. Company officials said the modern heating system has exceeded preliminary estimates for fuel economy and employe comfort.

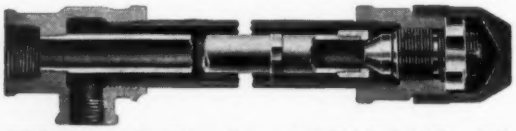
Electric Detector Finds Refrigerant Leaks in Processing Equipment

Refrigerating tanks must be tested during manufacture and maintenance periods to make certain that all welds and fittings are air-tight so that the refrigerant does not escape and spoil the entire contents of the tank. Processing equip-

NOT 1 CENT for Repair Parts

for 444 Nicholson Steam Traps Installed in 2 Years

Here is added evidence of the remarkably low maintenance costs of Nicholson expansion steam traps. In the 2 years Bradshaw & Co. have been distributing them in the Pittsburgh area they have installed 444 traps. But they have received not one order for repair parts. And examinations of traps in continuous drainage service for at least 18 months, at steam pressures to 250 lbs., showed no sign of valve cutting.



TYPE RF Expansion Steam Trap — Installed horizontally. Both types are for steam or hot water; pressures up to 250 lbs.

TYPE SF—Installed horizontally or vertically without supports.

Easily Installed, Low Cost

Because valve is easily adjustable to pass condensate at any temperature below 212°F., these traps are also widely used for regulating temperature of equipment.

For All Equipment Using Steam or Hot Water

Radiators	Kettles	Switch Heaters
Separators	Railway Coaches	Laundries
Paper Machinery	Dry Kilns	Plastic Molding Presses
Pipe Coils	Vulcanizers	

W. H. NICHOLSON & CO.
135 OREGON ST., WILKES-BARRE, PA.

Catalog 448 or see Sweet's

Representatives, in 53 Principal Cities, to Help You Solve Specifications and Maintenance Problems in Traps, Floats, Control Valves

ment built by the McHale Manufacturing Company, Los Angeles, Calif., falls in this category. Until recently, this firm tested all equipment under hydrostatic pressure. But

they now conduct tests more rapidly and with greater accuracy by means of a General Electric Type H portable leak detector.

By introducing a small amount of carbon tetrachloride into the refrigerating system, leaks can be quickly and easily located. The barrel of a hand-held "gun" is passed along

Is this the solution to your lubrication problems, too?

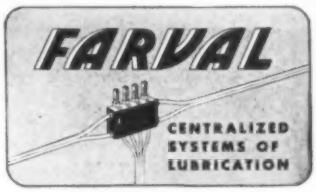
Write for these FREE bulletins

FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

For personalized service: Write or phone, John E. Millikan, Cleveland exchange—VUlcan 3-4560.



GENERAL
REG. U.S. PAT. OFF.

RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE — Roda and Stonega from Wise County, Va.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

ANTHRACITE — Hazle Brook and Raven Run Premium Coal.

Our personnel with the experience gained through long and varied marketing activity assures effective servicing of any fuel requirement.

General Coal Company

123 SOUTH BROAD STREET PHILADELPHIA 9, PA.

Branches:

BLUEFIELD, W. VA. BOSTON NEW YORK BUFFALO NORFOLK CHARLOTTE, N. C. PITTSBURGH CINCINNATI

the weld. When a leak is detected an indication on a control unit to which the gun is connected shows instantly that the weld is leaky. Headphones can be used in conjunction with the unit to give an audible indication of a leak.

Caterpillar To Build Earth-Moving Equipment At New Joliet Factory

Caterpillar Tractor Co., Peoria, Ill. has acquired approximately 300 acres of unimproved land near Joliet, Ill. on which it will immediately start construction of a new factory in which will be manufactured a large portion of the Company's extensive line of bulldozers, scrapers, wagons and rippers. Because of the lack of adequate space in its

Peoria plant, only a few component parts of these earth-moving units have ever been manufactured there. Fabrication has been handled for Caterpillar by subcontractors with final assembly at the Peoria plant.

Early this year, Caterpillar completed a multi-million dollar expansion program which added approximately 2,100,000 square feet of floor space to its Peoria plant, which will continue to manufacture tractors, diesel engines, motor graders and replacement parts.

It is planned that final assembly operations, using component parts produced by Caterpillar and the present subcontractors, will start in the Joliet plant even before the building is completed and the necessary machinery for fabrication is installed. Facilities will include a modern steel fabricating and assembly building, an office building, a heating plant and a sewage and water-treatment plant. The manufacturing facilities alone will cover approximately 700 thousand square feet of floor space.

Clean Oil and Wax Recovered From Petroleum Waste

A process to salvage valuable oil and wax from the "settlings" or waste material in the bottom of petroleum storage tanks and in earthen pits has been developed by the Bureau of Mines and successfully tested in a pilot plant in Kansas.

From 2,000 barrels of pit waste emulsion containing water and dirt among other things, the research chemists recovered about 600 barrels of clean oil, according to a Bureau report of the experiments. This oil contained 15 to 18% of microcrystalline wax, used in coating food packages, paper milk cartons, and products shipped to the tropics. This type of wax is said to stand more heat without melting than regular paraffin wax.

Application of this process may enable the petroleum industry to recover thousands of barrels of useful products from tank and pit settlings, the report points out, and help solve the ever-present problem of the economic handling and disposal of these waste materials.

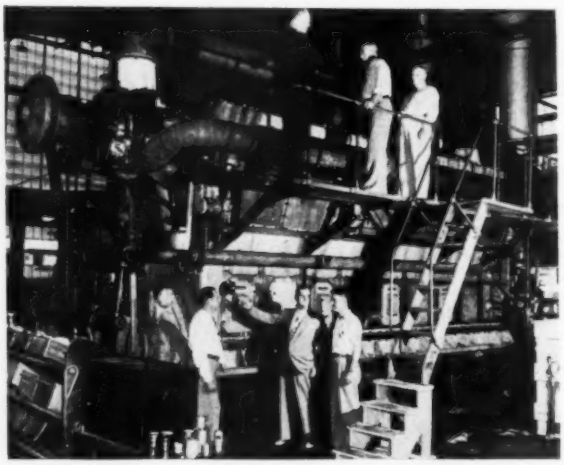
Details of the process are given in Technical Paper 715, "A Method Of Resolving Oil-Field-Waste Emulsions," obtainable from the U. S. Government Printing Office, Washington 25, D.C.

Tri-Fuel Engines To Generate 25,000 Kw For REA Project in Missouri

The $2,900,000 M and A Electric Cooperative electric-power generating plant in Popular Bluffs, Mo., considered to be the largest REA project of its kind in the country, will ultimately distribute over 25,000 kw, generated entirely by a new type of internal combustion engine. Known as the LSV-16 Cooper-Bessemer and developing over 3,400 hp, it is said to be the first engine of its kind in the world to operate entirely on diesel fuel oil, on natural gas alone or on any combination of fuel oil and gas.

During summer months when gas supplies are abundant, the LSV-16 will run as a supercharged spark-ignited gas engine, operating on low-cost gas at fuel economies as low as 6,500 Btu per brake hp-hr. In winter months when normally gas-rich areas like Missouri are subject to gas limitations or to cut-off entirely, the LSV-16 can continue to operate at unusual fuel economy as a dual-fuel engine. Engine controls automatically regulate the ratio of oil to gas depending upon supplies and varying from 100% diesel fuel oil to principally gas, using as little as 2% pilot fuel oil.

Dual-fuel or gas diesel engines as they are often called are, of course, nothing new to the engine industry. However, the new type LSV-16, according to Ralph L. Boyer, Cooper-Bessemer vice president and chief engineer, is the first engine development of its kind that makes possible efficient low-cost engine operation either as a four-cycle super-



charged spark-ignited gas unit or as a gas-diesel (dual-fuel) engine. Mr. Boyer reports that when operating on 100% gas fuel, the new type engine, when compared with conventional gas engines, produces more than 80% greater horsepower, while cutting fuel consumption by more than one-third; likewise, when running as a gas-diesel, the LSV-16 performs under greater economies than can be achieved with ordinary diesels.

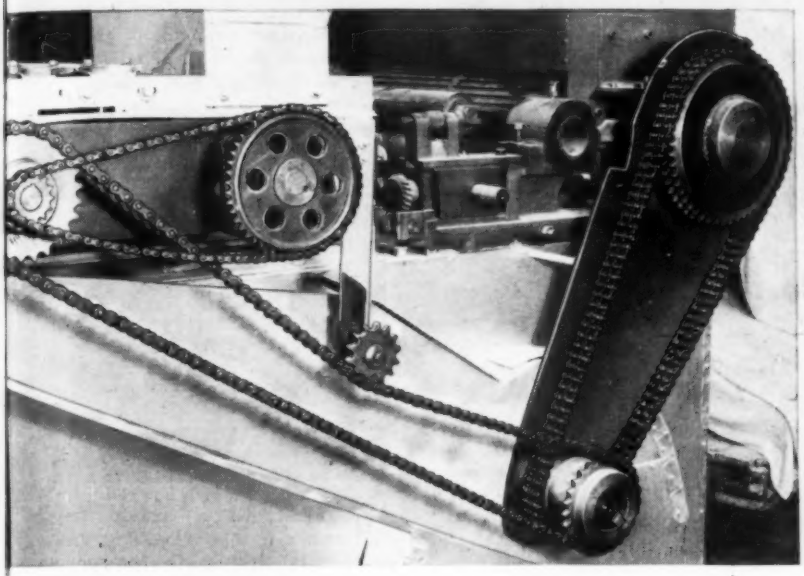
New Metal Melts at 85° F—Boils at 3,500° F.

Commercial uses are being sought for a costly, little-known metal which will melt when held in the hand, and has other unusual properties of so far undetermined utility. Called gallium, it is a by-product of the extraction of lead and zinc in the tri-state area of Missouri, Kansas and Okla-

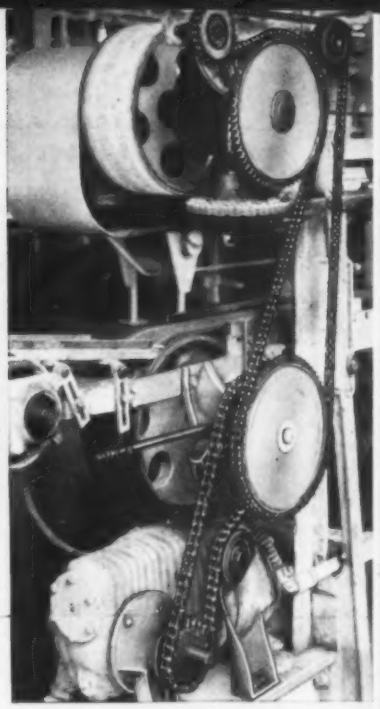
(Continued on page 152)

Today's Bakeries Use Modern Chain Drives

DIAMOND ROLLER CHAINS



Left: One double-strand and two single-strand Diamond Roller Chain Drives on rotary moulder.



Above: Output end of packaged product conveyor driven by two Diamond Roller Chain Drives. Exact timing relationship maintained.

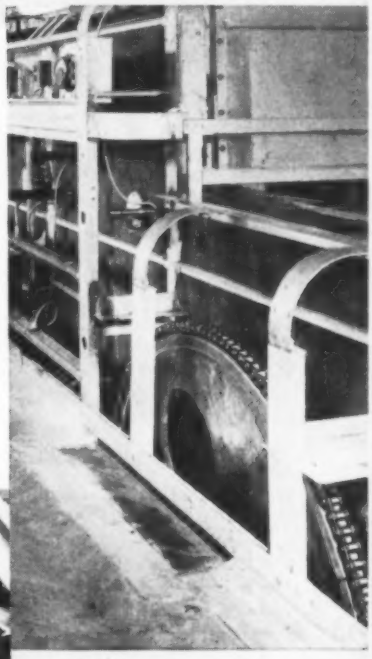
AT STRIETMANN BISCUIT CO. — the latest in modern methods and machinery combine to produce the finest products under the most ideal conditions.

Wide use has been made of Diamond Roller Chain Drives. Their adaptability is well illustrated in the installations shown, performing some operations difficult to accomplish by other means . . . Diamond Drives can meet your requirements, too. Practical recommendations are yours for the asking. DIAMOND CHAIN COMPANY, Inc., Dept. 412, 402 Kentucky Avenue, Indianapolis 7, Indiana.

Offices and Distributors in all principal cities.

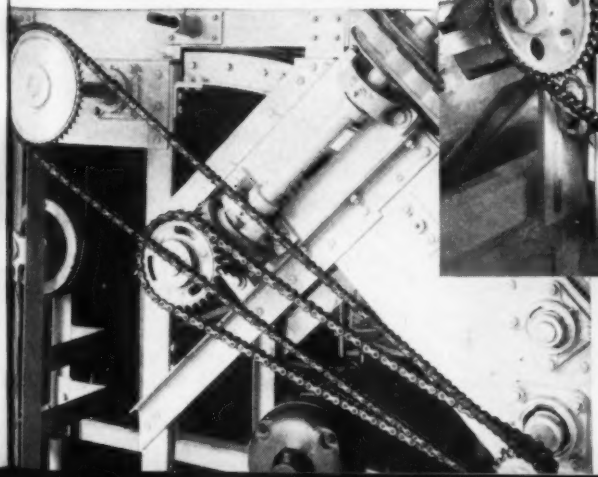
Refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER.

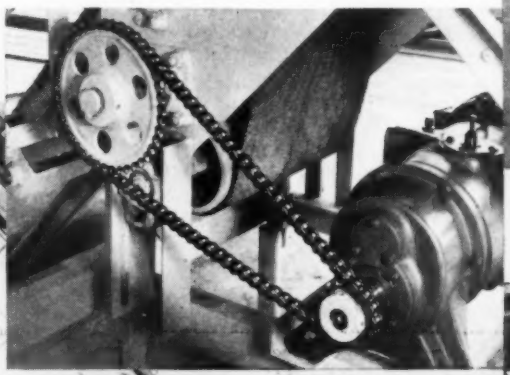
DIAMOND ROLLER CHAINS



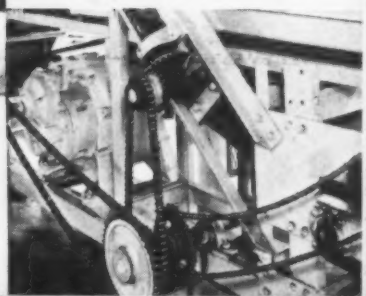
Above: Band oven driven by Diamond Roller Chains.

Below: Two single-strand drives from one shaft on carton conveyor.





Above: Primary drive to carton conveyor. Diamond #449 Roller Chain.



Right: Multi-shaft drives coordinating operation of carton conveyor by means of Diamond Roller Chain Drives.

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 16)

of Associated Factory Mutual and Underwriters Laboratories. It not only provides instantaneous response to flame conditions, preventing a discharge of unburned fuel to combustion chambers, but also incorporates an automatic check of its own components and will shut off the fuel supply in event of failure.

System can be interlocked with any needed combination of control devices and accessory equipment, such as excess-pressure, low-pressure and low-water safety cutoff, temperature control, alarms, and signal lights. It can be used for single or multiple burners.

319—GEAR REDUCTION HAS POSITIVE OIL PUMP

Two new gear reduction units—for vertical and horizontal transmission of power—have been announced by the Cleveland Worm and Gear Company. The worm and worming mounting are

identical in both units. The threads are formed integral with the shaft, which is journalled in anti-friction bearings. A composition face-type seal prevents oil leakage.

One feature common in both units is an oil pump which lubricates the upper gear bearing. An oil sump permits complete drainage.

The rectangular box housing is a gray iron castings which follows down to the flanged base. Seven sizes of units are available for each type. Shaft sizes range from 1⅛ to 4 in. dia.

320—DYNAMOMETER IS ADAPTABLE FOR FIELD USE

W. C. Dillon & Company, Inc. has announced a new addition to their line of precision testing devices—30,000, 40,000, and 50,000 lb capacity traction type dynamometers. The units can be

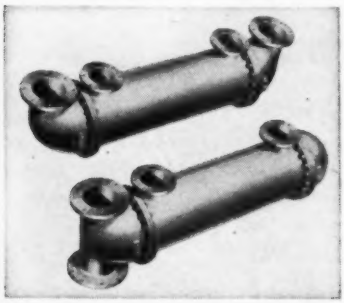
used for checking draw-bar pull, weight of bulky objects, tension in ropes or cables, and static loads. Large items that cannot fit into an ordinary laboratory tester can be handled easily.

The dial diameter of these new units is 10 in., which permits easy reading and fine increment breakdown. The instruments can be used indoors or outdoors wherever the job may be.

321—HEAT EXCHANGER HAS REMOVABLE TUBE BUNDLE

A redesigned line of heat exchangers are now available from stock is the latest announcement from the Young Radiator Co. Standardization will offer savings in both time and money by quicker delivery, and low original and maintenance costs.

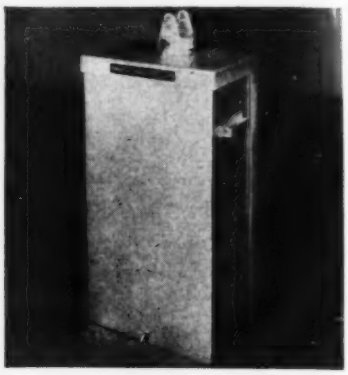
The units contain corrosion-resistant Admirality metal tubing (⅜ and ⅝ in. OD). Tube spacing and baffling are engineered to provide longer life, easier maintenance, and maximum heat transfer efficiency. The line consists of both single and two-pass models in a wide range of capacities.



The units are suitable for cooling engine jacket water and lube oil, bearings, machine tools, reduction gears, pumping units, turbines, cutting oil, quenching oil, transformers, industrial hydraulic equipment, generator sets, fresh water, and salt water.

322—OUT DOOR MECHANISM OPERATES AIR SWITCH

A motor operating mechanism for outdoor air brake and disconnecting switches is available from the Westinghouse Electric Corporation. The mechanism is of the torsional output type, and is available in a wide range of operating voltages. The air switch is driven by means of a single-phase or d-c motor, operating through a gear reduction to give proper operating speed. Slow-speed gears are chrome plated, hardened steel. The output shaft, to prevent coasting, is held by a spring-operated, solenoid-released brake. Auxiliary switches are available for operation of indicating lamps, electrical interlocks, and relay circuits.

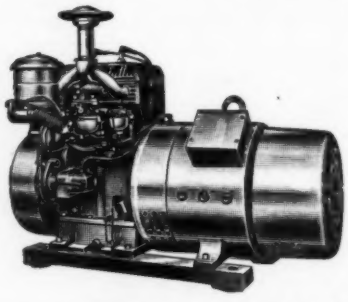


The mechanism is enclosed in a weatherproof sheet-steel housing, which completely protects all the components including the manual operation coupling. The cover can be lowered to allow manual operation without exposing the mechanism components to the weather.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

323—STAND-BY "POWER PLANT" GENERATES 110/220 A-C

Kato Engineering Company is offering a stand-by electrical power plant that consists of a two cylinder, air-cooled engine. There is no radiator;



consequently, the unit can be installed in freezing atmospheres. Equipped with a high-tension magneto permitting hand cranking, there is no need for batteries. The generator has a rated capacity of 5 kw and it will start single

phase motors up to and including 3 hp.

These stand-by power plants are designed to run at 1800 rpm, generators are built in 1200, 900, and 720 rpm, in capacities ranging from 500 w to 300 kw at 60 cycle. They are also available in frequencies ranging from 25 to 400 cycles.

324—BARREL TRUCK IS ONE MAN OPERATED

Modern Equipment Company, Inc., has just announced the development of a barrel truck, that is the latest achievement in materials-handling equipment to appear in the field. One man is able

to load and move the heaviest barrels, without the least danger of strain or accident. The truck wheels never leave the floor, eliminating the necessity of lifting in order to load the barrel onto the truck.

The new truck weighs only 56 lb and is available equipped with many types of rubber-tired and semi-steel wheels. Construction is entirely from steel, electrically welded for strength.

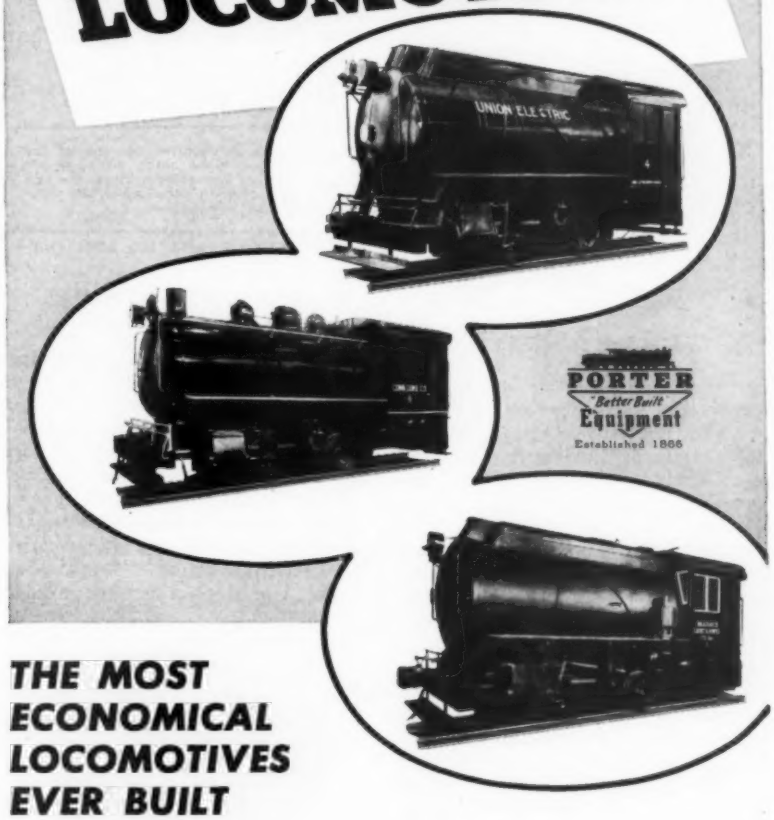
325—ROTARY METER IS COMPACT

An entirely new rotary meter, lighter in weight and compact in size, for tank truck, bulk plant, pipe line, indus-

PORTER

FIRELESS

LOCOMOTIVES



THE MOST ECONOMICAL LOCOMOTIVES EVER BUILT

Economical because they run on excess steam from your plant boilers, because they can be operated by unskilled labor, and because they require very little maintenance. These amazingly powerful industrial plant switching units are as uncomplicated as a toy. There is no firebox, electric motor, generator, or internal combustion engine. There are so few moving parts that replacements due to wear are rarely necessary. Porter Fireless Locomotives give practically 99% availability. If you are interested in saving up to 50% of your switching costs, send in the coupon today.

We are interested in knowing how we can cut switching costs with a Porter Fireless Locomotive.

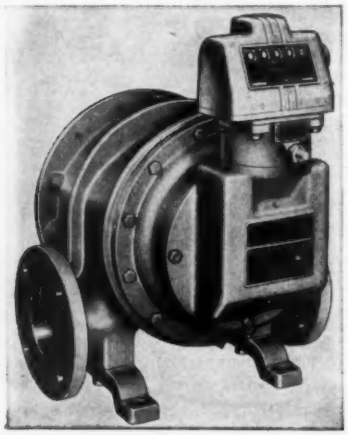
NAME.....

TITLE.....

H. K. PORTER COMPANY, Inc.
PITTSBURGH 1, PENNSYLVANIA
District Offices in Principal Cities

Pin this to your letterhead!

trial marine, high-speed fueling and other liquid measuring jobs, has been announced by Bowser, Inc. Complete dynamic balancing of the rotor assembly preserves accuracy and lengthens meter life by eliminating hydraulic and



mechanical stresses. Ball bearings and needle-type roller bearings on the rotor shaft and cam rollers are stainless steel, while the interior rotating parts are aluminum die cast, anodized aluminum, and cadmium plated steel to resist rust and corrosion.

Positive displacement measurement is accomplished in a precision chamber during each quarter revolution of the rotor. A simple gear change permits flow through the meter in either direction. Maximum capacity is 350 gpm at working pressures up to 125 psi. Flanges are standard 3 in. pipe. The unit may be installed vertically or horizontally. Available with large-numeral, straight reading dial or ticket printer. Dials can face in eight directions.

326—FIRE PROOF DOOR INCREASES SAFETY

Owens-Illinois Glass Company has announced a new heat insulation which is insoluble in water. Water, even at boiling temperature, has no permanent effect on its strength or insulation

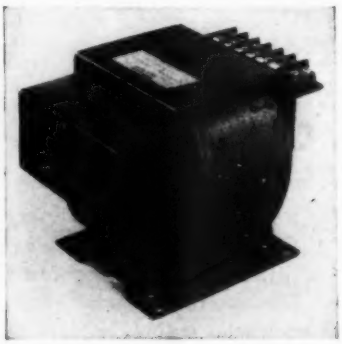
value. The insulation, in either block or pipe covering form, is effective in the entire temperature range from 200° F. to 1200° F.

Firedoors, flush wood veneer doors with incombustible cores of Kaylo insulation, bare the Underwriters' Laboratories label. The entire perimeter of the door is banded with hardwood, treated with a fireproof agent. During test runs temperatures as high as 1700° were recorded, with no apparent break through of the flame.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

327—TOOL TRANSFORMERS ARE STANDARDIZED

Machine-tool control transformers which follow NEMA standards—announced by Westinghouse Electric Corporation—are particularly adapted to the inductive, low-power factor loads of solenoids, relays, and contactors making up machine tool control equipment. Secondary voltage remains above 90% of rated voltage, and load current of 7 times normal at 20% load power factor. Use of grain-oriented magnetic

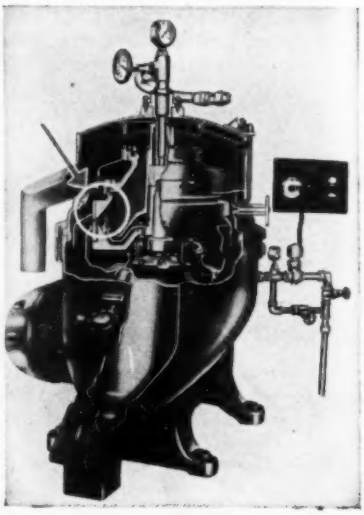


steel reduces size and weight and improves performance.

Circuit-breaker protection is normally supplied on ratings 0.300-kva and larger; for ratings 0.150-kva and smaller, a block is mounted for fuses. Ratings covering over 90% of all requirements of voltage, kva, and frequencies are available, which include seven sizes from 0.075 to 1.5 kva for 220/440 volts primary to 110 volts secondary at 60 cycles. Transformers for 50-cycle operation are available in six sizes ranging from 0.150 to 1.5 kva for 208/220/380/416/440 volts primary to 110/95 volts secondary. Three sizes from 0.150 to 0.500 kva are available for 25-cycle operation at 220/440/550 volts primary to 110 volts secondary.

328—CENTRIFUGE PROVIDES SOLIDS CONTROL

Sharples Corporation has announced a new line of centrifuges that feature external control of solids discharge and solids consistency. The unit employs the stratification principle of high separating efficiency combined with high capacity, and developes a centrifugal force equal to 6,200 times the force of gravity. Ten externally controlled solids discharge valves are lo-



cated radially around the inside of the bowl, which are operated by the admission of water (or other operating liquor) through a separate channel of the centrifuge. Both the frequency and duration of valve opening are precisely adjustable and the centrifuge provides: (1) control over the consistency of solids; (2) minimized loss of mother liquor with solids; and (3) greater scope of centrifugal application in that flocculent suspensions, slimes, and other troublesome solids can be efficiently handled. Available as either a spearator or clarifier. Discharge is generally controlled by external timers, but operation may also be by process control instrumentation.

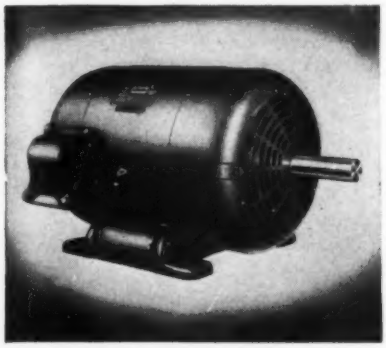
329—TUBE EXPANDERS COMES IN TWO STYLES

Two styles of rolling and flaring tube expanders have recently been developed by the Gustav Wiedeke Company for installation and maintenance of superheater and small tubes in high and low pressure water tube and boiler

units. The expanders can be supplied with header mandrels 19 in. long, drum mandrels 12 in. long, and short mandrels 7 in. long to meet the varying conditions. Universal joint drives are also available that are suitable for reaching through the small hand or plug holes to operate short mandrels when rolling and flaring tubes are set at an angle to hand hole.

330—EXPLOSION PROOF CONSTANT-SPEED MOTOR

Totally enclosed explosion-proof Life-Line squirrel cage motors are available from Westinghouse Electric Corporation. Heavy steel construction and special primer, thermoset varnish, and nitrocellulose base finish are used for resistance to corrosive atmospheres. Pre-lubricated ball bearings provide effective lubrication without attention—no greasing program is necessary.



These motors are designed for constant speed drive applications, such as pumps, blowers, or compressors, and may be safely used in any location where Class I Group D explosive materials or atmospheres are encountered. Available frames sizes are 224 to 326; 1 to 20-hp ratings; for 2 and 3-phase, 25, 50, and 60-cycle; 208, 220, 440, and 550-volt service.

331—NEW PIPE THREADER IS AVAILABLE

A new and improved ½ to 2 in. portable pipe and bolt threader has been announced by the Quijada Tool Co., Inc. New features include four front jaws, that automatically grip the pipe, and four rear jaws, that automatically center pipe to prevent whipping. The

IRON BULWARK
AGAINST CORROSIVE FLUIDS
Fairbanks®
all iron gate valves
...are made of high-test alloy iron to withstand the action of many of the strongest chemicals such as concentrated sulfuric acid, alkalies, aniline oils, sodium and potassium cyanides and creosote. These iron body valves give long service under the severe operating conditions that exist with use of these destructive agents.
Fairbanks All Iron Gate Valves—like those in all Fairbanks lines—are low in maintenance cost, easy to operate and long-lasting in service...a real answer to cost-cutting needs today.
Fig. 0318
ALL IRON GATE VALVE
150# SWP 225# WOG
Non-Rising Stem • Solid Wedge • Taper Seat
½"-2" Sizes
Fig. 0904
ALL IRON GATE VALVE
125# SWP 200# WOG
Solid Wedge • Taper Seat • Malleable Iron Seat Rings
2"-12" Sizes
Fig. 0418
IRON BODY U-BOLT GATE VALVE
150# SWP 225# WOG
Bronze Mounted • All Iron Rising Stem • Solid Wedge • Taper Seat
½"-4" Sizes
For handling other types of corrosive fluids such as dry carbon dioxide, ethyl acetate, malt beverages, propane and butane gas use FAIRBANKS BRONZE SOLDER END and FAIRCO-BRAZE (silver-brazed) VALVES.
For full details consult your distributor or write direct
THE Fairbanks COMPANY
393 LAFAYETTE STREET • NEW YORK 3, N.Y.
Branches: New York 3 • Pittsburgh 22 • Boston 10 • Rome, Ga.
CASTERS • TRUCKS • VALVES • DART & PIC UNIONS

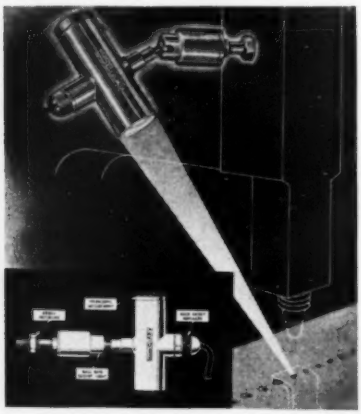
chucks are operated automatically when the push-pull switch is actuated. A chip pan slides out for easier cleaning.

Cutting oil is pumped through telescoping oil lines directly onto cutting surfaces. The unit utilizes a die head for each size of pipe that has a reamer attached to each head and reams while threading. When the proper length of thread is cut, a bell rings, notifying operator to open the die head. Cutter assembly is mounted conveniently for cutting off immediately after making up fittings.

The new threader weighs 160 lb and is ideally suited for tract or shop work.

332—SPOTLIGHT ELIMINATES BLIND OPERATION

Recently developed spotlight accurately locates work on all blind operations and overcomes the difficulty of positioning large assemblies on all types of equipment such as resistance welders,

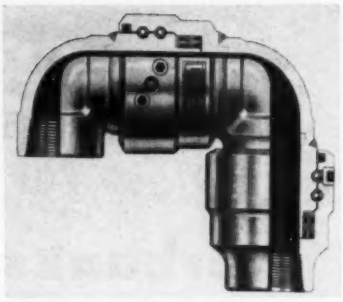


automatic riveters, dimpling and countersinking machines, punch and drill presses, and other production equipment.

Easily positioned on a ball and socket joint, the spot of the light can be adjusted to as small as $\frac{1}{8}$ in. dia. Intensity is great enough to be clearly visible under all sharp lighting conditions. The unit is entirely chrome plated, with a special lens to permit a sharp definition of the spot in a wide diameter range. It can be equipped with a 100 or 220 volt transformer depending upon the line voltage.
Sciaky Bros., Incorporated.

333—PIPE-COUPLING HAS BALL BEARING SWIVEL

An improved ball-bearing swivel pipe coupling has been announced by Gil-Lair Products, Inc. that is streamlined throughout, has no projection, and is free from bolted flanges, threaded sleeves, locking rings, and keys. The rotating members of the coupling are held tightly together with two sets of ball-bearings operating in



flame-hardened and ground ball races. The coupling is designed for an average speed of rotation not to exceed 60 rpm. The double, metal-backed packer assembly consists of two packers each being comprised of a "T" shaped metal backer to which a pair of synthetic rubber lips are vulcanized and bonded.

All high pressure swivel pipe couplings are made of steel. The low pressure couplings are made of aluminum, bronze, malleable iron, or steel. Available in a wide range of sizes, and for working temperatures up to 225° F.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

334—RADIATION DETECTOR IS PORTABLE

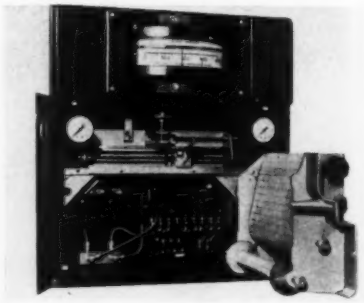
A new portable radiation detector, which enables the operator to measure radioactivity from a distance, has been announced by the Special Products Division of the General Electric Com-

pany. The new instrument can be used for monitoring areas in which radioactivity is suspected or for other types of radiation metering.

A detector located at the tip of a 4 ft probe converts radioactive emanations into electrical energy. This detector consists of an electronic tube and a phosphor, a material which gives off light in the presence of radioactivity. Light from the phosphor acts upon the electronic tube and converts light energy into electrical energy and amplifies its magnitude. At the other end of the instrument, a dial is activated by amplified energy from the tube and registers the amount of radiation. The detector is powered by 1,000 volts induced from low-voltage batteries, enclosed in a box that can be carried over the operator's shoulder.

335—CHART RECORDER IS PNEUMATICALLY OPERATED

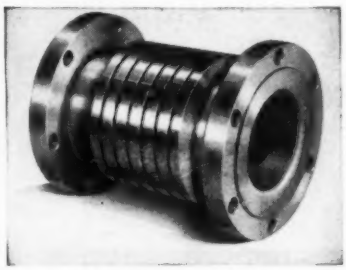
The Wheelco Instruments Company announces the incorporation of a new air-operated strip chart recorder into



their line of indicating, controlling, and recording instruments. With this new unit temperature, speed, flow, pressure, static grain loads, a-c or d-c volts, and amperes can be measured easily with flexibility, accuracy, and simplicity. The control function is performed by the smooth floating power of air operating diaphragm motors connected to valves, dampers, levers, and pistons. The instrument is completely self-contained and has two air connections.

336—EXPANSION JOINTS DESIGNED FOR PRESSURE

Chicago Metal Hose Corporation has just announced a line of high pressure expansion joints that consist of corrugated, bellow-type, sections of stainless steel, or other alloys, formed within integral control rings and end sections. Unlike the control rings normally used on controlled-flexing expansion joints, the rings are not bolted in place but



have intimate relationship with the pressure carrier.

These joints are manufactured with single or multiple plies and may be lined or unlined depending on application. Sizes begin at ⅝ in. ID and continue through the range of extra high pressure pipe sizes. Temperature range is from sub-zero to 1400° F for stainless steel. This upper limit can be exceeded with the use of special alloys. Working pressures of 1000 psi have been set up as a base standard.

337—INDICATOR HAS 270° DIAL SWEEP

Taylor Instrument Companies has developed a concentric or full-circle dial indicator for transmitting, receiving, and controlling instruments. Dial construction assures accessible for inspection or adjustment by simple rotation of the dial. The large pointer

with 270° sweep and white numerals on a black background stand out effectively, and accurate readings can be made from 50 to 100 ft.

The instrument is adaptable for low pressure, mercury manometer actuation for differential, or absolute pressure applications. It is available as a simple indicator and indicating receiver, controller, transmitter, transmitter controller, or receiving controller. Standard ranges are 0 to 10 on sq rt scale and 0 to 100 or 0 to 200 on uniform scales.

338—ELECTRIC CONTROLLER IS EXPLOSION PROOF

An explosion-proof float-operated electric controller for water tanks, receivers, and other liquid storage systems has recently been announced by McDonnell & Miller, Inc. Designed for conditions where a conventional type controller is not applicable, the unit will make or break electrical circuits at either high or low levels. Un-

DARTS
give a snug fit
without excessive
wrenching

The True Ball Joint of Dart unions are spherically-ground to form true-bearing surfaces. The reason Darts close tight... stay tight.

Less Expensive! You can get a snug fit easily without marring the seats of a Dart. You can uncouple them easily, too . . . use them over and over again to make important savings.

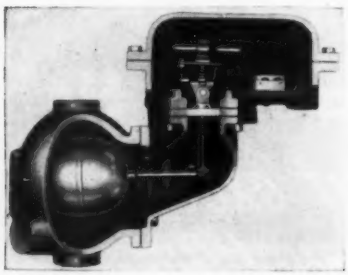
Practically Indestructible high-test, air-refined malleable iron is used for the body and nut of Dart unions. Another important feature that means longer, better service from Darts.

You'll find Darts always cost less in the long run because they give *longer service.*

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

derwriters' tested and approved for the following hazardous conditions: Class I, Group C—Atmospheres containing ethyl-ether vapors, ethylene, or cyclo-

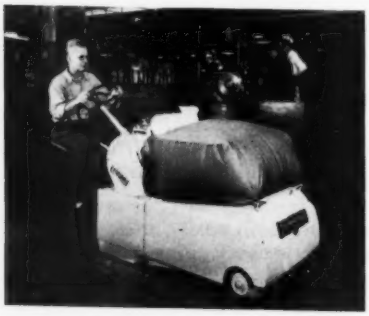


propane; and Class I, Group D—Atmospheres containing gasoline, petroleum, naphtha, benzine, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.

This dependable float switch incorporates packless construction, heavy-duty mercury switch, and totally enclosed wiring and terminals. It is furnished with a standard switch that breaks the circuit with falling liquid level, but a reverse acting switch is available for completing the circuit with falling level. Float chamber is heavy cast iron, float is copper, float rod is brass, and bellows are bronze. Maximum body pressure is 40 psi.

339—COMPACT POWER SWEEPER AIDS MAINTENANCE

Specially designed high-speed vacuum-equipped power industrial sweeper, developed by the G. H. Tennant Co., is said to have an exceptional sweeping capacity—over 43,500 sq ft per hour when operated by one man. A 24 in. wide brush revolves inside a sealed-to-



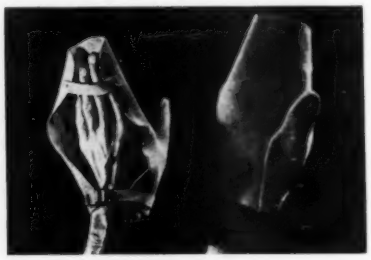
floor compartment, hurls dirt and litter into an inclosed built-in floating type hopper. At the same time a powerful vacuum fan draws dust into a heavy fabric bag. The hopper automatically compensates for irregular floor surfaces and bulky debris.

A two-speed transmission offers speeds up to 8 mph for open areas; and as low as 2 mph for safe handling in narrow aisles and crowded areas. Since brush and vacuum fan are powered directly from the 4.4 hp air-cooled engine, soilage pick-up is said to be efficient at all speed ranges. A reverse gear adds to maneuverability. The sweeper is equipped with front wheel automotive-type steering, both foot and parking brakes, with sealed ball and roller bearings throughout. Various types of brushes are available. A rotary side sweeping brush for sweeping flush with walls, machines, and under guard rails is available.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

340—GLOVE PADS PREVENT HAND INJURIES

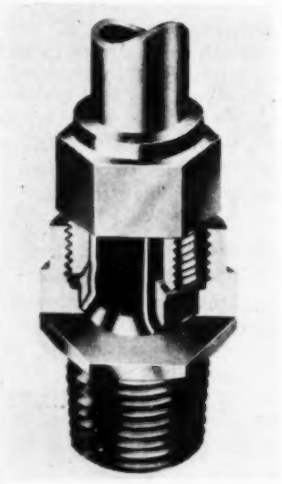
Handpads designed by safety glove specialists offer maximum protection and comfort. Adjustable to any size, the new snap-fastened strap keeps the pad



on and makes removal easy. Made from heavy genuine horsehide by General Scientific Equipment Co., the handpads prevent costly hand injuries and helps speed production. Time lost due to accidents and infections of worker's hands is greatly reduced. These long wearing hand protectors are especially made for handling brick, tile, metal sheets, stampings, sharp edged castings, cartons, paper, cases, and for many other uses where hand injuries are a risk.

341—NEW ALUMINUM FITTING IS SELF CONTAINED

A new all-aluminum fitting for use with annealed aluminum tubing is announced by the Scovill Manufacturing Company. This new aluminum design is a self-contained, two-piece fitting, with a self-flaring feature. The body of the fitting contains a flaring cone, and the nut contains a thrust collar. One turn of the nut, with an ordinary wrench, is sufficient to shear off the collar, and further tightening clamps the collar onto the tube to form a seal. The fitting may be disassembled and reassembled many times without impairing the tightness of the seal. In the aluminum type, the entire fitting is anodized for corrosion resistance, and during the anodizing a blue color



is added to the finish for identification purposes. These fittings are available in all standard shapes on a made-to-order basis for use with aluminum tubing 3/16 in. through 1/2 in. OD.

342—CO_2 EXTINGUISHER FIGHTS FIRES 20% FASTER

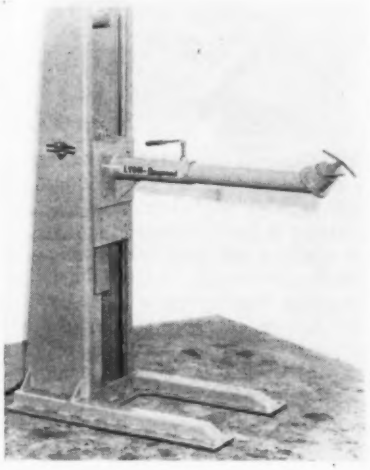
Deviating from its standard 4 and 5 lb sizes, Randolph Laboratories, Inc., has produced a new, portable 6 lb carbon dioxide fire extinguisher with 20% additional fire-fighting capacity. The unit is compact, light-

weight, and features a thumb-trigger release and self-aimed nozzle. Only one hand is required to operate this CO_2 extinguisher, from the instant it is removed from its bracket, until the flames are extinguished. The extinguisher has no valves or nozzles to adjust, contains 6 lb of non-toxic, non-damaging carbon dioxide gas, and is

especially adapted to smother flammable liquid and electrical fires. The extinguisher is approved by the Underwriters' Laboratories.

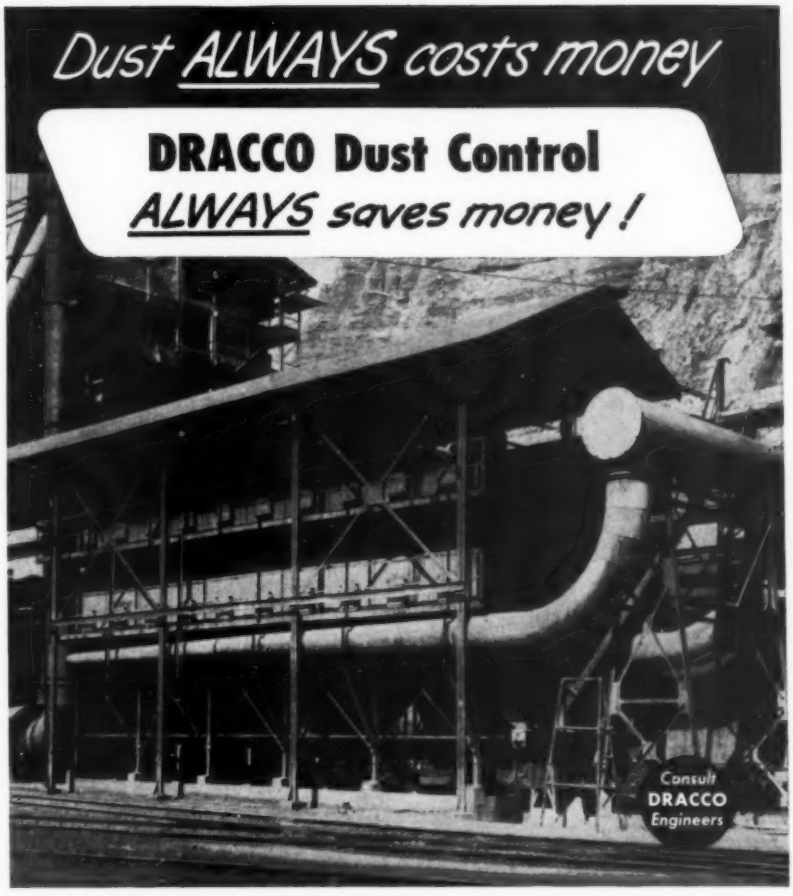
343—POSITIONER PLACES WORK AT MACHINES

An adjustable revolving arm to which various products can be mounted for assembly or welding operations is the feature of a new hydraulic elevating positioner. Various other standard attachments are available such as a balanced positioning arm, standard platform, special low height platform, and adjustable forks. Special brackets and fixtures can be designed to meet a customer's particular need where standard fixtures cannot be used. The positioner can be operated by a hand pump, foot pump, electric power, or air operated pump and has a capacity of 1000 lb. This new device is used for positioning work or materials in production centers, at the machine, and in welding, assembly, and inspection departments. Lyon-Raymond Corp.



344—SAMPLE OF BELT PRESERVATIVE AVAILABLE

New addition to the line of belt preservatives manufactured by the Cling-Surface Company is the new "50" which keeps belts from slipping and permits easy or slack belt operation. Applicator can is easy to use and permits keeping preservative near points of application. The preservative contains no rosin or harmful ingredients and regular applications will keep belts pliable and add years of life to belting. Treated belts require fewer "take-ups", deliver more power, last longer, and mean less production delays. Working sample available if request is made on company letterhead. Product available in either



An investment in DRACCO Dust Control is sure to pay off. It is a well known fact that dust, even in small amounts, is costly in many ways. Dust ALWAYS costs money. DRACCO Dust Control ALWAYS saves money. For that reason it is good business to eliminate any dust hazard as soon as possible. In every installation DRACCO Dust Control saves money — where recoveries are made the savings are often very substantial. Why not consult DRACCO Engineers? They have over 35 years' experience in dust and fume control. Perhaps they can save money in your plant.

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

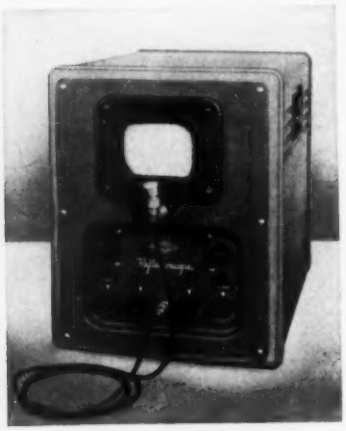
DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

quart or pint applicator cans, 12 or 24 cans to the carton.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

345—TESTS LOCATE DEFECTS IN METALS

An ultrasonic testing service provides day-to-day testing in the field or at the plant with a reflectoscope. The reflectoscope is used for locating de-



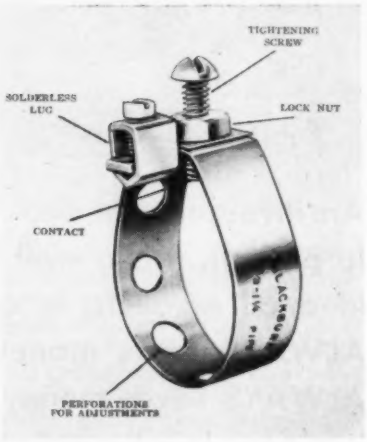
fects in steel, iron, and various nonferrous metals by applying a quartz-crystal searching unit to an outer surface. Internal defects are indicated on a cathoderay oscilloscope. A trained operator can locate an indicated defect accurately as well as determine its approximate size. Typical general applications of the reflectoscope are the testing of blooms and billets of various grades of steel, tool steel stock before machining, rolls, shafts, axles, piston rods, crank shafts, studs, bolts, and other machine components, and butt welds. Sperry Products, Inc.

346—FLUE GAS IS CONTINUOUSLY ANALYZED

A rapid and accurate analysis of flue gas is possible with a new continuous indicating and recording flue gas analyzer, manufactured by the Davis Instrument Division of Davis Emergency Equipment Co., Inc. Instrument operates on the thermal conductivity method of gas analysis. One of the important features that makes this analyzer outstanding is the effective scrubbing and conditioning of the flue gas sample by means of a special gravity type water aspirator, which controls moisture content and the temperature of the sample, and at the same time removes corrosive sulphur dioxide and foreign matter. Other features of the instrument are: filament block is precision milled from a solid stainless steel block; filaments are mounted on glass insulated posts on a removable stainless steel cover plate; the flow chain cabinet is suitable for wall mounting; and its cell compartment is insulated and dust-tight with temperature thermostatically maintained.

347—GROUND CLAMP FOR PIPES IS ADJUSTABLE

An adjustable ground clamp is now available in two sizes; one to fit $\frac{3}{8}$ to $1\frac{1}{4}$ in. pipe, and the other $\frac{3}{8}$ to 3 in. pipe. A tightening screw chafes the pipe, draws up slack, cuts through rust and dirt and at the same time contracts band around the pipe surface assuring a perfect ground. The clamp consists of a flexible, perforated pure copper band which encircles the pipe. A boss raised on the flat end of a removable copper alloy terminal lug fits into band holes and is machined to give a clean and smooth contact surface. The tightening screw with a



lock nut is threaded through the boss. There is no nut to grip while screw is tightened. For ease in installation, band is properly tempered and formed at one end. Blackburn Specialty Co.

348—CONDUIT BENDER IS REMOTELY CONTROLLED

A hydraulic, remotely-controlled thin-wall conduit bender for $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 in. conduit sizes has been added to the Blackhawk Manufacturing Co. line of pipe benders. Same advantages in the thin-wall conduit bender are obtained as in the rigid pipe and conduit benders because of the hydraulic unit. Major features are: remote-control which enables the operator to work safely at a distance and sight the bending progress from any convenient spot;

all-directional operation which prevents air-binding in the bending unit and enables the operator to use the bending frame in a vertical, horizontal, or elevated position; and extra utility when the hydraulic unit is detached from the bending frame and used with standard maintenance attachments as a general use jack. The pump operates any hydraulic system up to 10,000 psi.

349—COATING APPLIED COLD IN SINGLE OPERATION

New corrosion protection coating yields substantial savings in labor and equipment for corrosion protective operations, because it gives complete protection in a single operation, requires no heat or flame, no solvents or greases. The coating is an oriented polyethylene film with a synthetic adhesive applied to one side. Because of its elasticity, the tape maintains a permanent pressure around the coated metal equal to the tension used in applying it; this pressure prevents the flow of moisture between the tape and the protected metal. Bauer & Black Div., The Kendall Company.

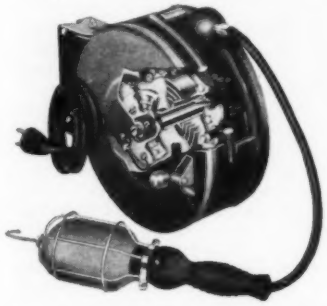
350—POWDER PACKED FUSES AVAILABLE IN TWO TYPES

Ware Fuse Corporation has added a complete series of powder packed fuses in 250 and 600 v and from 3 to 600 amp. The fuses are filled with a commercial composition to cut down the arc and eliminate the flash through cases when fuses blow. The units are inexpensive for one time use in manufacturing plants and construction industries.

The knife blade type has tamperproof drive screws to hold caps securely. Knife blades are held in perfect alignment to insure good contact and efficiency. The ferrule type assures efficient operation by concentrating heat to the center of the fuse and holding heat loss at clips to a minimum.

351—CORD REEL IS ELECTRICALLY OPERATED

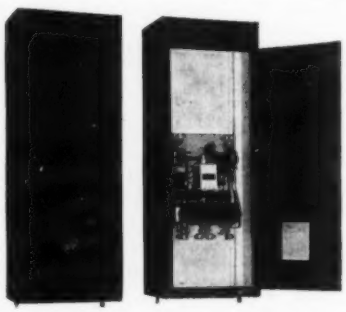
Announcement has been made by Acro-Motive Mfg. Company that an electric cord reel is now available. The



unit is of heavy duty construction with oversize bearings and shaft and has a large and powerful motor spring. One feature of this reel is the external trigger lock and the design used in getting the cable out of the reel. Cable outlet has a long opening which is equipped with a roller at each end and a heavy side beading that apparently offers greatly increased cable life. This reel, equipped with a swivel mounting, reduces cable wear as the unit will swing when cable is pulled sideways. A 30 in. plug-in lead is furnished. Handle and guard are of popular automotive design.

352—TWO NEW UNITS ADDED TO SOLENOID STARTER LINE

Alternating current, across-the-line solenoid starter made by Allen-Bradley Co. has been extended by the addition



of two new larger units—sizes 6 and 7. The switch construction follows the familiar solenoid design that has been standard for sizes 0 to 5 inclusive. Both units have the one-piece magnetic plunger which operates with a vertical straight line motion. The fully enclosed double break, silver alloy contacts do not require cleaning, filing, or dressing. The solenoids are energized with direct current drawn from a self-contained selenium rectifier. Both starters have adjustable thermal overload relays. All terminals and wiring are accessible from the front.

ARE CONSISTENT PERFORMERS IN ALL APPLICATIONS

Drainator operation is positive since it is dependent upon the non-changing laws of thermodynamic properties of steam and hot water.

Long satisfied Drainator users "repeat order" to insure steam trap systems that deliver positive consistent performance.

The ADVANCED STEAM TRAP *with NO Moving Parts*

Drainators are free of floats, valves, bellows and any moving parts. They are adjusted at the orifice when installed and their positive continuous operation is visibly indicated on the special gauge glass.

Installation is inexpensive since Drainator's "straight through" piping takes less time and fewer fittings. No by-pass is necessary.

Drainators are available in a range of sizes to solve all your steam trap problems.

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502 BANK STREET • PAINESVILLE, OHIO

DRAINATOR-THE ADVANCED STEAM TRAP

MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

Midwest Power Conference—April 5, 6 and 7, Hotel Sherman Chicago, Ill. More than 60 papers dealing with 20 phases of the production, transmission, and consumption of power will be presented at the conference.

Subjects will include: Steam generation equipment, electrical equipment, feedwater treatment, fuels, system planning and design, power system operation, rural electrification, central station plants, small power plants, industrial application of electrical energy, electronics applications, power plant design and construction, steam applications, atmospheric pollution, diesel engine maintenance, heat pump, heating and air conditioning, gas turbine locomotives, and relay testing practices.

Sponsored by Illinois Institute of Technology and 18 co-operating midwestern universities and professional societies, including: Iowa State and Michigan State colleges, Northwestern and Purdue universities, the Universities of Iowa, Illinois, Michigan, Minnesota and Wisconsin, the Chicago sections of the American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, and American Society of Mechanical Engineers.

Also the Illinois section of the American Society of Civil Engineers, the Illinois chapter of the American Society of Heating and Ventilating Engineers, the Western Society of Engineers, Engineers' Society of Milwaukee, and the National Association of Power Engineers.

ASME Spring Meeting—April 12, 13, and 14, Hotel Statler, Washington, D. C. Forty-five papers will be presented during 21 technical sessions sponsored by 19 professional divisions and committees of the society, and the American Rocket Society, ASME affiliate. Papers will cover aviation, power, fuels, industrial instruments and regulators, management, heat transfer, machine design, education, applied mechanics, metals engineering, gas turbine power, oil and gas power, cutting fluids, metal cutting, rocketry, process industries, wood industries, safety and lubrication.

AIEE Power Conference—April 19 and 20, William Penn Hotel, Pittsburgh, Pa. Sponsored by the AIEE National Technical Committees on Power Generation, Industrial Power Systems and System Engineering. A total of 18 papers will be presented in four sessions, as follows:

April 19, 1950—Morning Session:

Elements of System Capacity Requirements, by C. W. Watchorn, Pennsylvania Water and Power Co.

Economic Evaluation of Unit-Type Generating Stations, by W. J. Lyman, C. E. Mullan, R. M. Buchanan, Duquesne Light Co.

Survey of New Station Costs, by A. E. Knowlton, Electrical World.

Fire-Fighting Problems in Generating Stations, J. J. Shoemaker, The Detroit Edison Co.

Afternoon Session:

Maintenance and Overhaul Scheduling, by W. C. Bryson, Duquesne Light Co.

Steam Station Efficiency Control, by B. G. A. Skrotzki, Power.

Efficient Use of Operating Personnel, J. A. Brooks, F. Van Olinda, Consolidated Edison Company of New York, Inc.

Methods of Storing, Handling and Controlling Material and Supplies, by A. Gastler, Consolidated Edison Company of New York, Inc.

April 20, 1950—Morning Session:

Modern Trends in Industrial Electric Power Distribution, by D. H. McIntosh, Allis-Chalmers Manufacturing Co.

System Neutral Grounding in Industrial Plants by D. L. Beeman, General Electric Co.

Electrical System of a Pharmaceutical Plant, by J. M. Webb, R. H. Whaley, Eli Lilly and Company.

Selection of Voltage for Industrial Plants (Particularly Steel Mills), by H. B. Tracker, Westinghouse Electric Corp.

Low Voltage Switchgear for Large Commercial Buildings, by E. Burgin, A. Conangla, I-T-E Circuit Breaker Co.

Afternoon Session:

Using 600—and 460-v Power Systems With Grounded Neutrals, by J. E. Arberry, Pittsburgh Plate Glass Co.

Minimizing Industrial Production Losses From Voltage Dips, by E. L. Tornquist, E. A. Armstrong, Public Service Co. of Northern Illinois.

Supplying Power to Industry, by F. F. Dickman, West Penn Power Co.

Application of Capacitors to Industrial Systems, by J. E. Barklen, R. N. Bell, Westinghouse Electric Co.

U. S. Technical Conference on Air Pollution—May 3, 4, and 5, Wardman Park Hotel, Washington, D. C. Dr. Louis C. McCabe, chief of the Bureau of Mines Office of Air and Stream Pollution, is in charge of plans for the conference, which will comprise seven panel meetings to consider the numerous problems arising from air contaminants and ways of solving them. Panel subjects are:

Meteorology: the relationship of weather to air to air pollution.

Health: the effect of air pollution on health.

Instrumentation: the devices used for detecting, collecting and determining air contaminants.

Equipment: the equipment used to prevent air pollution, such as electrostatic and sonic precipitators, scrubbers, fabric bag collectors for dust, devices for burning coal smokelessly, etc., and new developments.

Analytical Methods and Properties: the micro-chemical analysis of very small particles of air contaminants and combinations of contaminant.

Legislation: the legal problems arising from air pollution, laws to control air contamination and their enforcement, and new legislation.

Agriculture: the effect of air pollution on crops and animals, including destruction of growing crops.

First Annual Houston Industrial Exposition—May 10-14, the Coliseum, Houston, Texas. Ed. G. Lenzner is General Manager. Scientific instruments, equipment and machinery for industrial plants, manufacturing plants, chemical plants, refineries and oil drilling and production equipment will be exhibited. The Exposition is a nonprofit corporation operated by industry itself for industrial, technical and scientific advancement and will present extensive displays of the most modern designs in tools, machinery and equipment as well as the newest developments in metals, plastics, chemicals and allied materials.

Society For Experimental Stress Analysis—Spring Meeting, May 25, 26, and 27, Hotel Statler, Cleveland, Ohio. Details of meeting can be obtained from the Society for Experimental Stress Analysis, P. O. Box 168, Cambridge 39, Massachusetts.

Wisconsin Power Conference and Exposition—June 7, 8 and 9, Hotel Schroeder, Milwaukee, Wisconsin. Co-sponsored by the Wisconsin State Association of the National Association of Power Engineers and the Associate Engineers and Supplymen of Wisconsin: Walter W. Roock, secretary, 3430 W. Forest Home Ave., Milwaukee 15, Wisconsin. Subjects to be covered will include: Economic and operating comparisons of coal, oil, and natural gas; boiler water conditioning; refractories; electricity; pumps; heating and ventilating; plant maintenance and plant safety.

Institute of Northwest Resources—Second Annual Meeting, June 19-30, Oregon State College, Corvallis, Ore. Prof. J. Granville Jenson is Coordinator for the Institute. The two week institute will feature some twenty outstanding authorities on Northwest regional resources development and utilization in daily seminar discussions on selected topics currently of urgent importance to the Northwest. Opportunity will be provided for teachers, business, civic and professional leaders to become better informed on the state of Northwest regional development and with the plans now being carried forward by existing agencies. Critical analyses for interpreting regional development propositions such as the CVA will be presented. Field trips for observation of resource utilization will form an outstanding part of the two weeks session.

NEW BULLETINS

(Continued from page 22)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 37.

for 3/8 to 8 in. bore. Link-Belt Company.

Disc Files (NN) Specifications are listed and typical mountings are shown in a two page folder presentation of disc files. The files are suitable for use on brass, bronze, and numerous alloys. Recommended speeds for four file sizes are included in table form. Kennametal Inc.

Tube Cleaners (OO) Tube cleaners for all purposes are described in a new 28 page illustrated bulletin. Applications cover tube cleaners for removing scale and other types of encrustation from tubes or pipes in boiler room equipment, oil refineries, and process plant. Various types of motors, cutter heads, drills, brushes, operating hose, and coupiings are fully described. Many helpful hints are offered on the care and operation of tube cleaners. Elliott Company, Lagonda Division.

Lock Nuts (PP) Information on lock nuts has been assembled in a new illustrated folder that includes two interesting case histories and suggestions for various applications. The Palnut Company.

Wagon Drills (QQ) An interestingly illustrated 10-page bulletin describes three models of wagon drills in detail and includes pertinent testimony of applications. Worthington Pump and Machinery Corporation.

VALVES, PIPING AND FITTINGS

Valve Selection Chart (RR) A handy new reducing valve selection chart has just been released in conjunction with a reducing valve bulletin. The chart helps to determine proper valve sizes, and clearly indicates which valves are suitable for dead-end service and which are not. In many cases valve users will specify for dead-end service valves, which are not tight closing. The valves thus chosen prove to be unsatisfactory and often dangerous to the users. Klipfel Valves, Inc.

Valves (SS) New bulletin describing globe and angle stop valves has just been issued. The bulletin gives design details, dimensional data, and material specifications for new forged steel valve series built in both 600 and 1500 psi classes. Valves are of drop forged steel construction and can be had with either bolted or union bonnets and with either screwed or socket welding ends. Edward Valves, Inc.

HEATING, VENTILATING AND AIR-CONDITIONING

Electrostatic Precipitation (TT) Two-color 16 page bulletin on electrostatic precipitation is profusely illustrated with photographs and diagrams.

. . . for the RIGHT hose for every need!

When you buy Hewitt-Robins industrial rubber hose, wrapped inside every cover is almost a century of hose-making experience. You don't pay extra for it . . . it *pays off* in longer, more efficient service on the job.

Hewitt-Robins research chemists know that no one type of hose can meet *all* the problems of industry. That's why they use natural and synthetic rubber, cotton, rayon, nylon, glass, chemicals by the score —in whatever raw material combination is best for each service requirement. Testing engineers torture hose at the plant . . . give it months of wear and tear in a few days. Field engineers the country over help users get the longest service at the lowest cost.

All of which means that the Hewitt-Robins name on a hose means it's *right for its particular job.*

Typical examples of Hewitt-Robins *specially engineered rubber hose are:*

Acetylene • Acid • Air • Alcohol • Barge Loading • Butane-Propane • Cement Placement • Fire • Flexible Rubber Pipe • Foam • Fuel Oil • Hydraulic • Mill • Oil Industry • Pneumatic Tool • Rotary Drilling • Sand Blast • Steam • Suction • Vacuum, Industrial • Water • Welding (Twin-Weld®)

Whatever your hose needs, it will pay you to put the problem up to hose headquarters. Call your Hewitt Rubber distributor (see classified phone book—"Rubber Products" listing) or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N. Y.

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BELT CONVEYORS *(belting and machinery)* • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

The publication explains how electrostatic precipitation works, gives case histories of seven typical installations, where the system is being used, and describes the various methods of electrostatic precipitation and the electric equipment applicable to each method. General Electric Company.

Corrosion Resisting Fans (UU) New bulletin shows new drive construction for larger fan sizes. Contains general information on alloys, standard constructions, and applications. Also details of important types and accessories with advice on selection of right fan size. The Duriron Company, Inc.

Dust Collectors (VV) Rapid Selection of correct size unit type dust collectors for any industrial dust problem requiring from 200 cfm to 3,600 cfm is given in a new bulletin. Among tabulated comparison of units are general recommendations of typical wheel sizes that any single unit will handle. Also given is an exact method for determining the correct amount of air suction required at any wheel in accordance with New York State Code requirements. Aget-Detroit Company.

Humidity Control (WW) Recently published pamphlet illustrates and discusses a controlled humidity method to obtain dry air without mechanical refrigeration. A four color diagram shows the step-by-step process in which the air is dehumidified by absorption. Niagara Blower Company.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

MISCELLANEOUS

Reference Table (XX) A linear conversion table converts in. and fractions of in. into decimal parts of a ft has been printed by this Company. The table is suitable for many purposes in addition to those encountered in the application of steel tubing. The table is arranged on a single card. The Babcock & Wilcox Tube Co.

Dust Control (YY) Three new folders describe economical control of coal dust, foundry dust, and dust in industrial plants. Cause, effect, and treatment are described. Aquadyne Corp.

Safety Equipment (ZZ) 1950 catalog of personal protective equipment and industrial safety devices, has just been released. Catalog covers respiratory devices, eye protection, carboy pumps, drum pumps, miscellaneous industrial safety equipment for use in industries, mines, and utilities. General Scientific Equipment Company.

Butt Welding (AAA) Advantages of flash butt welding by controlled techniques and typical product applications are shown in a new fully illustrated 20 page booklet. Products and subassemblies ranging in size from 4 to 100 in. in dia. and up to 16 miles in length are described. Numerous case histories and actual shop practices are explained and illustrated. The American Welding & Manufacturing Co.

BOOK REVIEWS

Personnel Problems

"Office Workers' Manual," by Alexis R. Wiren. Published by Bureau of Business Practice, Division of National Foremen's Institute Inc., New London, Conn. Illustrated. 36 pages. 50 cents.

Turnover among office personnel has always been a costly and time-consuming problem. Young people, particularly, seem to feel they can always get another job—that the first or second are merely training for future jobs in other companies. When they run into the natural disappointments, jealousies, and dull routines of office work, they quit. Only several jobs later do they realize those problems are universal.

Wiren's book is designed to help business cut down on this unnecessary turnover. Under 28 headings, office workers are shown that their problems are everybody's problems. But Mr. Wiren goes further by showing the reader which type must be faced and which can be ignored. He shows how to handle all of them.

Transformers

"Transformer Principles and Practice," second edition, by J. B. Gibbs. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 18, N. Y. Illustrated. 232 pages. $3.50.

This book consists of 24 chapters covering all aspects of the construction and use of transformers, including underlying principles, applications, connection, testing, care, and economics.

The first chapter introduces the subject by way of fundamentals of transformer performance and construction. There follows descriptions of many particular types of transformers—large and small—for various purposes. Transformer connections, phase transformation, polarity, ratio adjustment, mechanical forces, and other subjects are dealt with in detail. The revised edition includes a new chapter on current-limiting reactors, plus many new illustrations.

The book is the third volume in the "Westinghouse-McGraw-Hill Engineering Books for Industry" series. The author is a design engineer in the engineering department of the Transformer Division, Westinghouse Electric Corporation, Sharon, Pa. He has been with this division since coming to Westinghouse in 1905.

Flow Meter Engineering

"Principles and Practice of Flow Meter Engineering," seventh edition, by L. K. Spink. Published by the Foxboro Company, Foxboro, Mass. Illustrated. 416 pages. $7.00.

This handbook, widely accepted as a standard text and guide, has just appeared in a new and enlarged edition, the seventh since the book was first published, in 1930. Much new and valuable material has been added, making the book a complete, up-to-date, and authoritative treatise on all phases of flow engineering.

The book covers its field thoroughly. All the necessary information is given for calculating an orifice, flow nozzle, Venturi tube, Pitot tube, or even a pipe elbow used for flow measurement. The common pressure tap locations are discussed, and data given to correct for odd tap locations. Liquids, steam or other vapors, and gas are handled in separate sections. Instructions, curves, and tables are presented in logical sequence and simple manner. Viscosity corrections are furnished in convenient form.

Equations and curves for calculating throttling orifices to be used at critical pressure drops are a new addition to the book. Other new features include a complete section on measurements of fluid flow in metric units, a table of corrections for barometric pressures, a table of pressure multipliers up to 5000 psi, a description of practical methods of applying A.G.A. Gas Measurement Committee Report No. 2, new and simplified instructions for use of the square-root planimeter on gas meter charts, and pages of examples of typical calculations in flow meter engineering.

A new section is contributed by R. L. Parshall, inventor of the Parshall Flume, giving design details, operating instructions, and tables for measuring flows through open channels by means of weirs and flumes.

Centrifugal Pumps

"Engineering Papers of Hydraulic Institute", volume II, published by Hydraulic Institute, 90 West Street, New York 6, N. Y. Illustrated. $2.00.

This volume contains the following papers, winners of awards in various engineering contests sponsored by Hydraulic Institute for the employees of its members, to stimulate their interest in the many phases of the pump industry: "Cavitation in Centrifugal Pumps", by A. J. Stepanoff; "The Centrifugal Pump in the Process Industries", by A. T. Nielsen; "The Operation of Centrifugal Boiler Feed Pumps", by Hans Gartmann; and "Submergence for Centrifugal Condensate Pumps", by Hollis T. Waldo.

Public Speaking

"How To Become A Successful Public Speaker," by Harold P. Zelko. Published by The National Foremen's Institute, New London, Conn. Illustrated. 176 pages. $2.50.

Here is an entirely new approach to the subject of speech. In effect it is a full course in public speaking, and is particularly adaptable for group studies. The author assumes that people are already set in their ways so far as pronunciation and diction are concerned. But in spite of the minor mistakes they make, they can become interesting speakers. Such terms as modulation, pitch, voice control and the like are scarcely mentioned.

Instead the emphasis is placed on two simple ideas: "what do you want to say?" and "how should you say it?". This system to learn to speak effectively, decisively and without hesitation is the same one Mr. Zelko uses in teaching adult groups and college students at The Pennsylvania State College where he is Associate Professor of Speech.

NEWS...
of men and companies

Combustion Engineering—Superheater, Inc.—Frederick Alan Schaff, chairman of the Board of Combustion Engineering—Superheating, Inc., died at his home on Tuesday evening, February 7, at the age of 65. Widely known in both railway and power fields, Mr. Schaff was an officer or director of numerous companies manufacturing equipment for both fields. These included, besides Combustion Engineering—Superheater, Inc., The Lummus Company, chairman and director; The Superheater Company, president and director; American Throttle Company, president and director; The Air Preheater Corp., chairman and director; Franklin Railway Supply Company, director; Combustion Publishing Company, president and director; and foreign affiliates of several of the above companies.

F. A. Schaff

Mr. Schaff attended Culver Military Academy and Purdue University from which he graduated in mechanical engineering in 1907. Following graduation he worked for Boston and Albany Railroad, the New York Central Lines, irrigation and power engineering in Texas, before joining the service department of Locomotive Superheater Company in 1913. In this company he became assistant to the vice president and in 1916, vice president. He was elected president of The Superheater Company in 1930, successor to the Locomotive Superheater Company; became president of Combustion Engineering Company, Inc. in 1933; elected chairman of the board in 1940; and, upon the merger of The Superheater Company and Combustion Engineering Company in January 1949, became chairman of the board of the combined company.

Mr. Schaff was a Fellow of the American Society of Mechanical Engineers and a member of The Newcomen Society, Academy of Political Science, Iron & Steel Institute, the Navy League of the U. S., Society of Naval Architects and Marine Engineers, as well as many social organizations and clubs.

York Corp.—Appointment of four new distributors has been announced by John R. Hertzler, vice-president and general sales manager. These organizations are: The Calcasieu Lumber Co., 201 W. 2nd St., Austin, Tex.; the Clayton C. Smith Co., 702 Mulberry St., Williamsport, Pa.; the Hawes Electric Co., 333 Washington Ave., Huntington, W. Va.; and the Modernized Equipment Co., 922 Race St., Cincinnati, O.

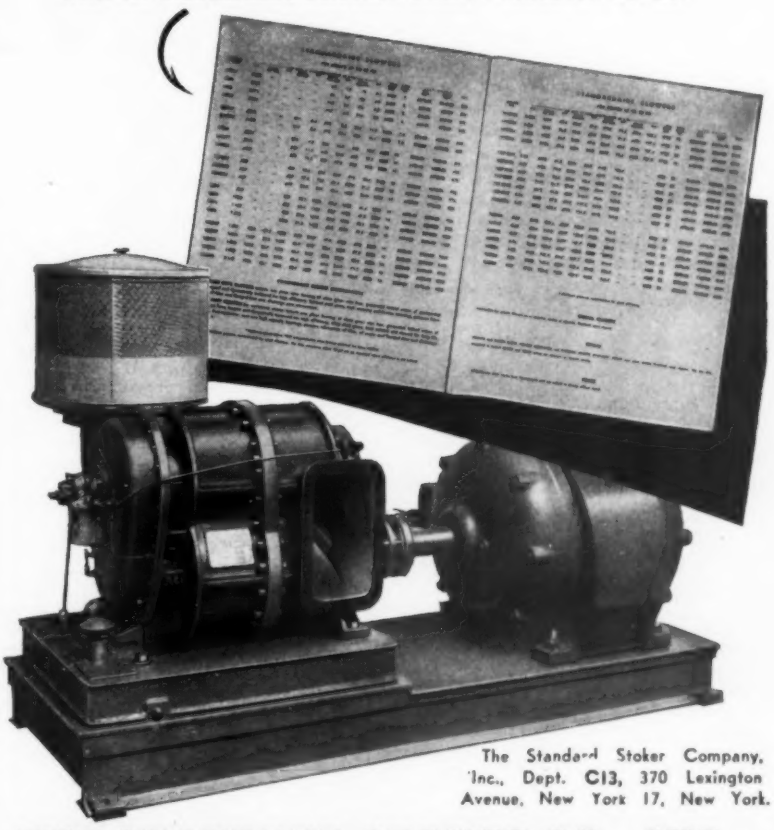
The Calcasieu Lumber Co. is one of the oldest operating business houses in the state of Texas and has had consider-

The STANDARDAIRE
PRECISION BUILT
Axial Flow BLOWER

To meet specific and variable pressures, Standardaire Positive Displacement Blowers are built in a series of sizes to fulfill a wide range of capacity requirements from directly connected, standard speed motors—the modern method of producing just the amount of air required at the minimum cost. Direct-drive motor speeds also provide for an even air flow resulting in smaller pulsations that are easy to dampen out and do not create shock loads in the blower or delivery system. If the type of service demands other than direct drive, a pulley attachment can be readily applied to the blower for particular specifications.

The flexibility of speed and pressure possible with the Standardaire Blower eliminates a great number of blower types normally required in the positive displacement field—a desirable engineering advancement in blower design without disturbing fundamental principles.

For full information and a complete list of blower sizes, write for Standardaire Selection Chart, Publication No. 86.



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THE STANDARD STOKER CO • INC •

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able experience in the air conditioning and refrigeration field since 1941. The Calcasieu territory includes 18 Texas counties.

Clayton C. Smith of Williamsport has years of experience in the air conditioning and refrigeration field and since July has operated his own business. His territory will include North-Central Pennsylvania counties.

Gordon L. Hawes, owner of Hawes Electric Co., is well-known throughout his territory and has been in the electrical contracting business for the past 30 years. His distributorship will include counties in West Virginia and Kentucky.

C. S. White, president of the Modernized Equipment Co., of Cincinnati, has been in the store fixture business for the past 25 years and has had considerable experience in the factory and retailing business. This territory includes counties in Ohio, Indiana, and Kentucky.

Under the York contract these distributors will handle all air conditioning equipment up to and including 30-hp. and refrigeration installations up to and including 10-hp., frozen food cabinets, automatic ice makers, and other ice-making equipment.

Goodyear Tire and Rubber Company—J. E. O'Conner, 28, has been appointed manager of Packing and Special Products Sales department to replace W. F. Ong, who has been appointed manager of Wringer Rolls Sales department, according to H. D. Foster, Mechanical Goods division manager. Mr. O'Connor received a BS degree in aeronautical engineering from the Lewis Institute, and was an engineer for Martin Aircraft, prior to service in the Air Force from 1943 to 1945. He was a

J. E. O'Conner

W. F. Ong

member of Fairfield Engineering Company's engineering department from 1945 until October 15, 1948, when he joined the Goodyear company as a staffman in Pliotherm Sales department.

Mr. Ong has been with Goodyear for 26 years. He joined Goodyear in 1913 and became a district manager for mechanical goods. He then left the company in 1923, returning in 1934 to the position from which he was just promoted.

Union Carbide and Carbon Corporation—After thirty-five years of service, J. M. Spangler—former director, vice-president, and general manager of the National Carbon Division of Union Carbide and Carbon Corporation—has been appointed president of the Division. Mr. Spangler's first assignment as an employe of National Carbon in 1915 was contacting railway purchasing agents. In 1923 he was put in charge of the Chicago sales office and moved up to general sales manager ten years later. In 1943, Mr. Spangler was made vice-president in Charge of Sales, and in 1944 assumed the post of vice-president and general manager, which he leaves now to take on the leadership of the entire National Carbon organization.

Mr. Spangler is well known in automotive and electrical circles through his activities in the sale of anti-freeze, flashlights, and batteries. In taking over his new position, Mr. Spangler takes charge of a nation-wide organization which has an extremely varied line of products.

J. M. Spangler

J. L. McGara

H. K. Porter Company, Inc.—Mr. T. M. Evans, president of H. K. Porter Company, Inc., has announced the appointment of Mr. John L. McGara as general manager of the Pittsburgh district operations. Mr. McGara is to have charge of sales and operations of the three Porter plants in the Pittsburgh district; the Porter plant at 49th Street in Lawrenceville, where locomotives, quimby pumps, and the Porter line of mixing and blending equipment are manufactured; and the two plants of the American-Fort Pitt Spring Division at 56th Street in Lawrenceville and at McKees Rocks, Pennsylvania.

Watson-Standard Co.—This company has just announced the appointment of C. R. H. Carlson as district manager in charge of the Chicago Metropolitan area. Mr. Carlson previously was associated with Atlas Power Company in the development of technical coatings; Pittsburgh Plate Glass Company, as paint sales manager in Michigan; and Sherwin-Williams Company. He graduated from the University of Iowa with a BS degree in Chemistry.

Eriez Manufacturing Co.—R. A. Roosevelt has recently been promoted to the position of sales manager to fill the position vacated by George R. Wellmon, who resigned. Mr. Roosevelt will direct sales and advertising for the Eriez firm, which manufactures and sells magnetic separation equipment through 30 domestic and 22 foreign sales offices. Mr. Roosevelt has been advertising manager of Eriez for the past three years. Prior to this he was assistant supervisor of publicity at the Erie Works of the General Electric Co. He is a member of the National Industrial Advertisers Association, the Direct Mail Advertising Association, and a director of the Sales and Advertising Club of Erie.

United States Steel Corporation—Frank R. Burnette has been appointed assistant engineering vice-president of United States Steel Corporation of Delaware according to M. W. Reed, vice-president. Mr. Burnette will have special duties in connection with future construction programs of United States Steel.

Mr. Burnette attended Ohio Northern university and was graduated in 1910 with a degree in civil engineering. Before going to college he had been employed at Farrell works of Carnegie-Illinois Steel Corporation as a laborer, machine operator, and foreman. After graduation he returned to U. S. Steel as an inspector and estimator. Mr. Burnette is a member of the Engineers Society of Western Pennsylvania, Association of Iron and Steel Engineers, American Society of Civil Engineers, American Iron and Steel institute, and Eastern States Blast Furnace and Coke Oven association.

Plibrico Jointless Firebrick Company—Cody R. Beane has been appointed manager of the Plibrico Sales & Service Co., 1315 Hansford St., Charleston 1, W. Va. Mr. Beane succeeds the late Joseph S. Stanley who died on January 16 after serving as representative for over 20 years. Mr. Beane will act as distributor of Plibrico refractory products, maintaining complete boiler settings and installation service.

Society of Automotive Engineers, Inc.—Jack A. Nelson of Chicago, Diesel engineer with Standard Oil Company (Indiana), has been appointed general chairman for the national Diesel engine meeting of the Society of Automotive Engineers, Inc., at the Hotel Knickerbocker in Chicago November 2 and 3, 1950.

Mr. Nelson joined Standard Oil Company (Indiana) in 1937 as an automotive engineer and in 1942 became a Diesel engineer in the sales technical service department. Mr. Nelson, in addition to being the author of "Industrial Diesel Engines" and several other papers on Diesel lubrication, has done pioneer work in heavy-duty type oils in large industrial Diesel engines.

He is chairman of the placement division and a member of the governing board of the Chiicago Society of Automotive Engineers, Inc.

United States Steel Corporation—Appointment of John H. Elliott as assistant general manager of operations of Carnegie-Illinois Steel Corporation has been announced by this United States Steel subsidiary. At the same time, Armo L. Billeter was named general superintendent of the company's Irvin works, near Dravosburg, Pa., succeeding Mr. Elliott.

Mr. Elliott studied engineering at the University of Pittsburgh and started with U. S. Steel in 1919 in the engineering department of the former American Sheet and Tin Plate company in Pittsburgh. He was transferred to Shenango works as combustion engineer in 1926 and was promoted through the ranks to become assistant superintendent in 1937. Later that year, he was transferred to Irvin works as superintendent of the tin finishing division. He was named assistant general superintendent in 1947.

Mr. Billeter attended Kirksville State Teachers college and Colorado State university. He began with U. S. Steel in 1919 as a foreman in the annealing department for Gary sheet mill at Gary, Ind., and was transferred to Irvin works

as superintendent of the cold reduction department in 1937. Appointed in 1944 as superintendent of the Cornegie-Illinois plant at Vandargrift, Pa., he returned to Irvin works in 1947 as assistant general superintendent.

General Electric Company—J. E. Ryan and C. P. Hayes have been appointed staff assistants to B. A. Case, Manager of Engineering, Small Apparatus Divisions, according to Mr. Case. In their new posts, Mr. Ryan and Mr. Hayes will follow the engineering activities of specifically assigned divisions.

After graduating from Pennsylvania State College in 1934 with a BS degree in mechanical engineering, Mr. Ryan joined G.E. on the Test Course. He completed the Advanced Engineering Program in 1937 and was appointed supervisor of a mechanical design course. In 1940 he was transferred to the Control Engineering Division where he worked on design of control devices until 1945 when he was made head of the general research group. In 1947 he was appointed engineer in charge of general developments for the Control Division Laboratory, and was named engineer in charge of the laboratory last year.

Mr. Hayes received a BS degree in electrical engineering from the University of North Carolina. He joined G.E. in 1932 on the Test Course at Bloomfield, N. J., and after completing the Advanced Engineering program in 1935 was transferred to the Specialty Transformer Division at Fort Wayne as a design engineer. In 1937 he went to the Fractional-Horsepower Motor Engineering Division, where he stayed until 1946, reaching the position of assistant section engineer. He was then made division engineer of the Ballast Division, Specialty Transformer and Ballast Divisions, a post he held until this appointment.

Belfield Valve Division, Minneapolis-Honeywell Regulator Co.—Naming K. R. Knoblauch as manager of sales of valve products for the industrial division of Minneapolis-Honeywell Regulator Company, was announced by L. M. Morley, vice president and general sales manager of the company's industrial activities. Mr. Knoblauch joined the Brown Instruments division engineering work staff in 1924. In 1939 he was made assistant sales manager of the industrial division, with headquarters in Philadelphia. Four years later he was placed in charge of market extension and sales promotion. He will continue to make his headquarters at the Brown plant.

Allis-Chalmers Mfg. Company—Frank R. Freyler has been promoted to manager of Allis-Chalmers Mid-Atlantic region effective March 1 succeeding William Arthur, who has requested retirement, according to an announcement by J. L. Singleton, vice president and director of General Machinery Division Sales.

Mr. Freyler has been with Allis-Chalmers for 21 years, the last 20 months having been spent as Philadelphia district manager. He will continue to have his headquarters in Philadelphia.

Mr. Arthur joined Allis-Chalmers in 1925 and was manager of the Philadelphia district for 10 years before becoming Mid-Atlantic regional manager

The New

ROTOJET

Gives you the

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You won't believe any tube cleaner can pack such tremendous power, until you try the new ROTOJET. It removes scale so much faster that it usually pays for itself in one cleaning. Models available for practically any size straight and curved tubes. Send for ROTOJET Bulletin.

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ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

S-530 ROTOJET Air-driven Motor with swing-frame head for 3½"-3-13/16" I D straight tubes.

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Here are the "PRINCO" Thermometers for those really TOUGH service conditions. Cases are extra heavy castings, specially designed for maximum strength. Frames and cases are BOLTED together. Glasses are extra heavy plate to withstand shock and vibration. Cases completely sealed against fumes and moisture. Built-in dehydrator prevents fogging or condensation. Extra protection for mercury tubes assures maximum service life.

Available in all standard case angles and temperature ranges, or to your specification. RED READING MERCURY or Canary-backed tubing optional. Wide selection of "Princo" Separable Sockets in a variety of materials. Write for full information and prices. Ask for Bulletin "E".

NEW! **PRINCO "Easy-Setting" DIAL THERMOMETERS**

5 Standard Scale Ranges
"Easy-Access" Cases for Quick Setting
Simplified Dial and Pointer Adjustment
Rugged, Accurate, Bimetallic Unit
Write for prices and additional information.

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in June, 1948. He will serve as special representative for the region for the interim period before taking full retirement.

Arthur D. Brown, who has been manager of the Washington, D. C., office since 1947, succeeds Mr. Freyler as manager of the Philadelphia district office. R. N. Landreth, who has been associated with the Washington office since 1934, is the new manager of that office.

Goodyear Tire and Rubber Company—R. M. Junker, 29, has replaced Ernest Peterson as manager of the Industrial Roll Sales department, who has retired, according to H. D. Foster, manager of the Mechanical Goods Division.

After graduating with a BA and BS from Columbia engineering school in 1942, Mr. Junker joined Goodyear in the efficiency department. He was a wage analyst from 1943 to 1948, when

R. M. Junker

E. Peterson

he was appointed to a staff position in Tank Lining Sales department. Mr. Junker is a member of the Society of Professional Engineers.

Mr. Peterson joined Goodyear in 1943 as a staffman in the Mechanical Goods Division after 32 years' experience in the Rubber industry. He was appointed manager of Industrial Roll Sales in 1946.

The Cleveland Chain & Mfg. Co.—Richard R. Tettelbach has been appointed assistant advertising and sales promotion manager of the Cleveland Chain & Mfg. Co., Cleveland, Ohio, according to James W. Dickey, vice president. Mr. Tettelbach will be in charge of dealer promotion activities and will assist R. Bruce Vasey, advertising manager, in the preparation of publication advertising. A graduate of Princeton, he served three years in the Infantry, including 20 months in Europe. Prior to joining Cleveland Chain, he was associated with Hill & Knowlton, Cleveland public relations and publicity firm.

H. S. Brown

R. R. Tettelbach

Foster Wheeler Corporation—Harry Sanford Brown, president and chairman of the board of Foster Wheel Corporation, died February 18th of a heart ailment while en route to Rio de Janeiro.

Mr. Brown was born sixty-eight years ago in Tyler, Texas, a son of John A. and Emma Sanford Brown. He matriculated at University of Arkansas and received a BME degree in 1901. Three years later he obtained a degree from Cornell University. Mr. Brown left the Boston Office of the Power Specialty Company, which he managed from 1904 to 1918, to become vice president of Wheeler Condenser and Engineering Company, a position he held until 1927. When the two companies merged to form the Foster Wheeler Corporation, he was made vice president and a director of the new corporation. In 1935 he was elected president and in 1946 he assumed the additional title and duties of chairman of the board.

In addition to his duties with the parent company, Mr. Brown was a director of Foster Wheeler Limited of Canada and the Liberty Mutual Insurance Company.

Besides his wife, Mr. Brown leaves three sons, John A. of Orange, N. J., Harry S. Jr., of Elizabeth, N. J., and Frederick C., a student at Brown University; a sister, Mrs. Pledger Burke of Tyler, Texas, and two grandsons.

A. O. Smith Corporation—In a move to enlarge customer service throughout the country, this company has contracted for new manufacturing and supply facilities and has set up a more flexible sales organization, according to M. B. Sawyer, Jr., manager of the Motor Division. Contracts have been awarded to Whirl-A-Way Motors, Inc., of Tipp City, Ohio, to manufacture fractional horsepower motors to specification. These facilities will serve the eastern region of the United States. The western region of the nation will continue to be served by the Company's present Los Angeles motor manufacturing plant.

D. L. Mills, president of Whirl-A-Way, was appointed Eastern Regional Sales Manager of the Motor Division, with headquarters in Dayton, Ohio. Three sales managers will report to Mr. Mills. They are Hal E. Rowland, headquarters in Dayton; J. P. Hoffberger, New York; and R. O. Dehlendorf, Chicago. Mr. Rowland comes to A. O. Smith from the Delco Products Division of General Motors. Mr. Dehlendorf has been in the motor business for many years. Mr. Hoffberger continues as the A. O. Smith New York area sales manager. Sales in the eleven western states will be directed from the Los Angeles plant, which will also supervise sales in the southwest under area sales manager, George H. Nichols, with headquarters at Houston, Texas.

Caterpillar Tractor Company—According to an announcement by L. M. Neumiller, president, T. R. Farley has been named general manager of Caterpillar's new plant to be located two miles southwest of Joliet, Illinois.

Mr. Farley, after serving three years in World War I, joined the Holt Manufacturing Company at Peoria, Illinois, and since that time has acquired an unusually broad background in manufacturing and merchandising.

In March 1940, Mr. Farley was elected vice president of Caterpillar Tractor Co.—which had merged with the Holt Manufacturing Company and the C. L. Best Tractor Co., in 1925. Later in 1942, he also became vice

president of Caterpillar Military Engine Company, a wholly-owned subsidiary organized for the purpose of designing, constructing, equipping, and operating the Victory Ordnance Plant at Decatur, Illinois, for the manufacture of military type radial, air-cooled, diesel engines. Mr. Farley assumed full charge of the engine company in Decatur as executive vice president, until he was elected president in August 1944. After the engine company was dissolved in the fall of 1946, Mr. Farley returned to Peoria and since that time has been in charge of special projects for the Company.

T. R. Farley

J. J. Fetsko Jr.

The National Supply Company—Announcement has been made that John J. Fetsko, Jr., was appointed regional manager in charge of all inland waterways diesel sales, and will make his headquarters at Superior Engine Division's office in the Boatman's Bank Building, St. Louis, Mo. Prior to this appointment Mr. Fetsko had been the company's sales engineer in New Orleans. Mr. Fetsko has spent some 21 years in the marine field, has had extensive experience in the testing and operation of diesel engines and steam equipment, and is a graduate of the Carnegie Institute of Technology. He joined The National Supply Company's Superior Engine Division in the fall of 1948. Mr. Fetsko was employed as an assistant engineer and chief engineer on a number of towboats operated by the Dravo Corporation, as well as chief engineer on towboats of the Wheeling Steel Corporation. During the war he served as Chief Port and Trial Engineer with Ingalls Shipbuilding Corporation, at Decatur, Ala. Shortly before joining the National Supply Company, he was chief engineer for the Union Barge Line Corporation.

The Swartwout Company—The Ventilator Division of The Swartwout Company, Cleveland, now shares the company's New York City branch office at 103 Park Avenue with the Steam Specialties Division, according to an announcement by E. H. Bellard, Ventilator Division sales manager. Frederick Rickmeyer has been placed in charge, filling the vacancy created by the death of Percy Jones, for many years the New York representative. Eugene Rogers will assist Mr. Rickmeyer in ventilator sales engineering.

Westinghouse Electric Corporation—Mr. O. O. Rae, manager of the Southeastern District, announced the appointment of Mr. R. B. Church, Jr., as assistant to the district manager, and Mr. B. M. Gatling, Jr., as central station division manager. Both men will be located in Atlanta.

Mr. Church attended Northeastern

BY means of a simple, reliable stroke regulating mechanism which utilizes a conventional fixed-throw, solid forged steel crankshaft—the Aldrich-Groff "POWR-SAVR" Pump controls delivery in stepless, straight line variation from zero to 100% rated capacity *at constant pump speed.* An automatic monitor, this pump supplies *only that delivery actually needed.* Power consumption is in almost direct proportion to demand.

Built for long-term, low maintenance service *in the power field, for boiler or desuperheater feed,* the Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump offers highest possible volumetric and mechanical efficiencies. Units are built in six sizes, ranging from 2 to 6 inches in stroke and from 5 to 125 bhp. Over 500 units, many with 10 year service records, are successfully operating today.

Send for Data Sheet 65 for full details on how the Aldrich-Groff "POWR-SAVR" Pump can give you improved efficiency, simplified and reliable control of delivery, and lower operating costs. Write, without obligation, to:

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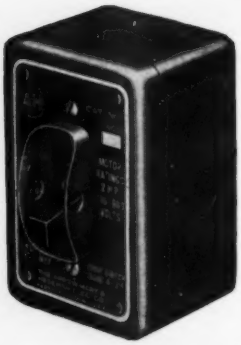

For controlling small motors (up to 2 HP) — for handling heavy lighting loads (up to 30A) — the 6808 is an old favorite with design and maintenance men. Small size and low cost make it ideal for a wide range of applications in which overload protection is not necessary. Cutaway shows these features: Bakelite arc snuffers increase breaking capacity • Kickoff release for positive, fast action • Long-lasting phosphor bronze switch blades • Heavy duty, wear-resisting, stationary contacts. 6808 is a 2 pole, 1 phase unit, rated 2 HP, 115-600V, AC or DC; 30A 250V, 20A 600V.

ARROW AH HART No. 7810 FOR USE WITH AC ONLY

The 7810 is a 3 pole, 3 phase unit, rated 2 HP, 110-600V AC; 30A 250V, 20A 600V AC. Silver, butt-type contacts give long life, accurate, positive slow-make and break action. Both models are available for surface- or flush-mounting; as explosionproof, dustproof or waterproof units. Both are no-fuse types; line is protected by normal fusing.

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University and joined Westinghouse in 1924. Since that time he has held various supervisory positions with the Company in Boston and Atlanta. Prior to his present assignment, he was office supervisor in the apparatus sales department. He succeeds Mr. John Gelzer, Jr., who retired.

Mr. Gatling, a graduate of North Carolina State College, joined Westinghouse in 1922. Upon completion of the graduate student course and the power sales course, he was assigned to the Charlotte N. C., sales office. His later assignments with the central station division were in the Florida and Georgia branches of the Southeastern District.

Sylvania Electric Products Inc.—C. W. Shaw, general sales manager of the Radio Tube Division, has announced that George R. Sommers has been appointed assistant general sales manager. Mr. Sommers will take on additional responsibilities immediately involving the policies and general management of the radio tube sales department. Joining the staff of Sylvania Electric Products Inc. as a lighting fixture specialist in 1940, he was transferred to the Washington, D. C., territory in 1943 where he instituted a decentralized sales policy—later adopted for Company district sales offices. He was appointed director of Pacific Coast Sales for Sylvania in 1945, and in 1949 he was transferred to the New York office and made assistant to C. W. Shaw. Mr. Sommers is a graduate of Northwestern University school of mechanical engineering in 1936, and a member of the National Federation of Sales Executives and the American Marketing Association.

H. I. Conner

G. R. Sommers

Hyster Company—According to a recent announcement from export manager John F. Johannsen of Portland, Oregon, Hollis I. Conner has been appointed assistant manager of the export division of the Hyster Company, manufacturers of industrial trucks and tractor tools. He will serve as head of Hyster's Peoria, Illinois, export department and as contact man between export headquarters in Portland and Hyster's two eastern plants. Mr. Conner has been with the Hyster Company for the past four years. During this time he spent six months in England, Sweden, and other parts of Europe; and two years in the Union of South Africa as export field representative. Tentative plans call for a three months' tour of the Caribbean area before assuming his duties in the new position. Educated in Oregon, Mr. Conner has a background of several years with the Tide Water Associated Oil Company, two years as store manager for the Good-

year Tire and Rubber Company, and four years in the Marine Corps in communications and engineering.

Black, Sivalls & Bryson, Inc.—Johnson Roney II has been appointed Florida representative of Black, Sivalls and Bryson, Inc. Mr. Roney, who resides at 608 Oak Avenue, Clearwater, has more than thirty years of experience in engineering and sales, which has been accumulated with such companies as RCA, General Electric, DuPont, and Hercules. For three and one-half years, Mr. Roney was sales manager for the La Bour Company, Inc. Since November, 1948, he has acted as sales representative for manufacturing equipment firms, among them the Lapp Insulator Company and Swenson Evaporators. Among the B S & B products he will handle are safety heads, combined units, relief valves, vent valves, and the new combined vent valve and flame arrester.

J. Roney II

Westinghouse Electric Corporation—Frank E. Bodine has been named assistant Central Station manager for the Pacific Coast District with headquarters in San Francisco. Formerly manager of maintenance sales, Mr. Bodine will serve electric utility customers throughout the Pacific Coast District. Mr. Bodine joined Westinghouse in 1926 after graduating from Colorado A & M College with a BS in ME. In 1928 he was transferred to the Salt Lake City office as a salesman, and in 1941 he was named sales manager. Mr. Bodine was transferred to the San Francisco office in 1944.

Mr. Bodine is a director of the San Francisco Sales Managers Association, a member of the Electric Club of San Francisco, the American Institute of Electrical Engineers, the Domestic Trade Committee, and San Francisco Chamber of Commerce.

Durametallic Corporation—Bullough Asbestos Supply Company of 764 W. 2nd South Street, Salt Lake City, Utah is the new representative for the Durametallic Corporation, manufacturers of metallic packings and mechanical seals. Ben Bullough heads this organization with Bill Seeley as sales manager assisted by Keith Swenson and Ralph Sartoria.

Durametallic Corporation Atlanta, Georgia, representative is Carl Houck, who is located in the Atlanta suburb of Chamblee at 5149 Ashford Dunwoody Road.

After an instruction period at the plant, Louis G. Collins has become a representative for the Durametallic Corporation products in Milwaukee, Wisconsin and surrounding area. His address is Stratford Hotel, 1404 W. Wisconsin St. in Milwaukee.

Ross Recktenwall Jr., formerly with Gunderson-Taylor Machinery Co., is promoting the sale of Durametallic flexible metallic packings and seals in the Denver Colo. area.

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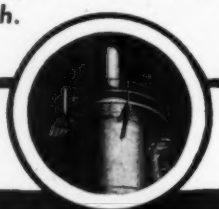

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Borg-Warner Corp.—Appointment ment of D. M. Berges as chief engineer was announced yesterday by R. J. Minshall, president of the Pesco Products Division of the Borg-Warner Corporation.

His appointment fills a vacancy in the engineering department organization which has existed since J. A. Lauck's election as vice president in charge of engineering several months ago. In assuming his new position, Mr. Berges will be in charge of all modern and extensive research facilities which are a part of the new Pesco plant in Bedford Township, near Cleveland.

Mr. Berges, who is a graduate mechanical engineer from Stevens Institute of Technology, Hoboken, N. J., has been directly associated with the design, manufacture, and sale of aircraft accessories since 1331. He has served as chief engineer of Pesco's Electrical Section since 1943, when he joined the Pesco organization to supervise the establishment of a department for the production of direct-current and special purpose electric motors to be used with the company's line of hydraulic, fuel, and fuel booster pumps for aircraft installations.

Texas Gas Transmission Corporation—James E. Allison has been promoted to the position of assistant superintendent of pipelines for divisions 1 and 2 of the company's pipeline system. At the same time Frank R. Baker was named as supervisor of Advalorem Taxes for the company. Both Mr. Allison and Mr. Baker will have their headquarters in Owensboro, Kentucky.

Mr. Allison joined Texas Gas in December, 1948, as a construction engineer for the company's new 26-in. natural gas pipe line from Texas to Ohio. Prior to this, he was pipeline superintendent for Modern Welding Company.

Mr. Baker joins Texas Gas after several years with two major natural gas pipe line companies as tax agent and adjuster. In his new position he will have charge of all tax matters for the company in state, county, school district and other local taxing groups throughout Texas Gas 2400 mile pipe line system.

Sylvania Electric Products, Inc.—The California sales division of this company has been reorganized into two separate divisions in order to coordinate sales and warehouse activities in each area, according to an announcement made here by Garlan Morse, West Coast division manager.

The Central Pacific division will have its headquarters in San Francisco, and the South Pacific division, will headquarter in Los Angeles. The change has been made, according to Mr. Morse,

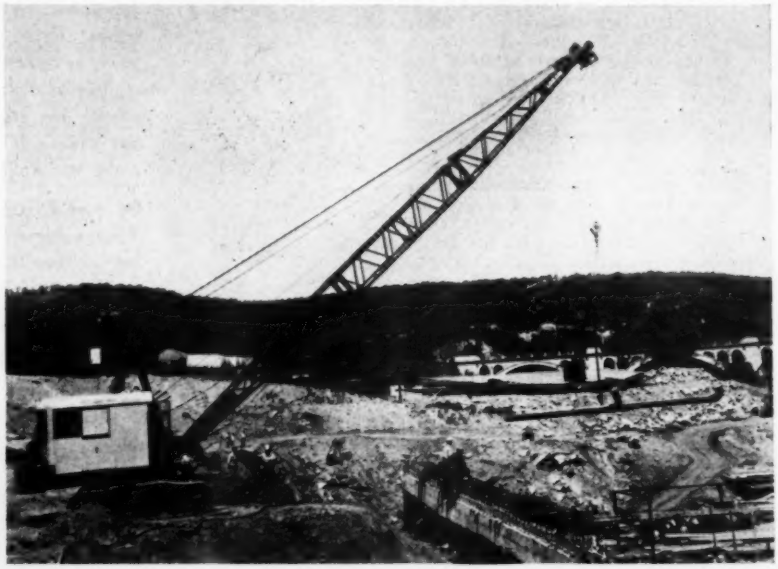
C. I. Brady

R. C. Harper

to facilitate speedier servicing of all Sylvania customers throughout the West Coast. The Northwestern division, headquartered in Seattle, will remain in operation to service that section of the country.

Robert C. Harper, formerly a member of the Los Angeles sales office, was appointed division sales manager of Lighting Products for the Central Pacific division. He will be responsible for sales of all lighting products and auxiliary equipment. Charles I. Brady,

(Continued on page 142)



Section of pipe being placed with a Lorain—80 crane during the construction of the Metropolitan Edison Co's new generating station at Popular Neck on the Schuylkill River south of Reading, Pa. This section is a part of the main building, which will be 263 ft x 216 ft. The entire project will cost approximately $25,000,000 and it is estimated that it will take 3 years to build

SPEAK NO EVIL

The rumor-monger is himself an evil, but only a monkey seals his lips against reality. And cancer is a grim reality. We must discuss the facts of cancer in order to help educate and protect our neighbors. For humanity's sake—and our own preservation — we must support the crusade against this mortal enemy of man.

GIVE TO CONQUER CANCER

AMERICAN CANCER SOCIETY

BE ON THE LOOKOUT FOR THIS CHARACTER! HE'LL TRY HIS BEST TO EAT YOU OUT OF YOUR JOB!
WASTIE
OUR INCOME
HE'S ROBBING YOU BY TURNING ERRORS, CARELESSNESS AND LOST TIME INTO DOLLAR$ FOR HIMSELF!

The ATF Incorporated group of companies, to tighten production, costs, and quality standards, has enlisted the aid of a character named Wastie, the central figure in a series of cartoon-style incentive posters. Of course, Wastie eats money, loves oil-slick, and accident-causing floors. He dotes on slipshod methods that make the scrap pile grow, and he is passionately fond of the lazy and forgetful. Sample sets of the posters for reproduction and use by companies in their plants are available. Write to the ATF Incorporated, human relations department, 200 Elmora Avenue, Elizabeth 8, N. J. for all requests

1950

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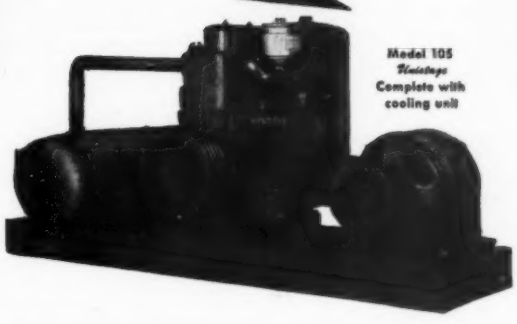

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Built and designed for continuous heavy duty service with a minimum of attention.

Available in "V" or Flat Belt Drive . . . on base for belt drive from motor or engine . . . or, with direct motor drive. No special foundation required . . . can be bolted to any substantial floor.

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Webster Traps are known as "quality traps". This reputation did not happen—it was earned in thousands of installations over a period of 60 years. Top efficiency plus extra years of service make Webster Traps a great buy. When you purchase traps, select on the basis of years of efficient service per dollar —and you'll say Webster.

Webster makes a "family" of traps —each designed to provide automatic, continuous, and complete discharge of air and water of condensation. Steam is held back until it has given up its useful heat. Full technical and price information available on request to any one of Webster's 60 Representatives in principal cities. Or write us direct.

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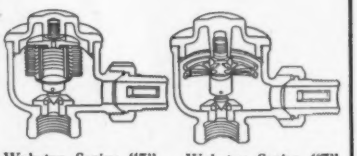
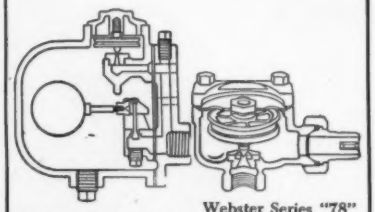
FIVE WEBSTER TRAPS IN 15 BODY MODELS



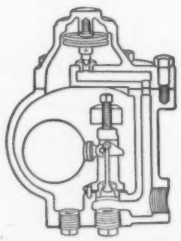
Webster Series "5" Thermostatic Trap, bellows type, for low pressure vapor and vacuum heating. Up to 15 lbs. ½, ¾, 1" sizes.

Webster Series "7" Thermostatic Trap, diaphragm type, for low pressure vapor and vacuum heating. Up to 15 lbs. ½, ¾, 1" sizes.



Webster Series "26" Heavy Duty Drip Trap for pressures up to 15 lbs.

Webster Series "78" Thermostatic Trap for process, 10 to 150 lbs. ⅜, ½, ¾ and 1" sizes.



Webster Series "79" Float and Thermostatic Trap for pressures of 15 to 150 lbs.

Webster HEATING

(Continued from page 140)

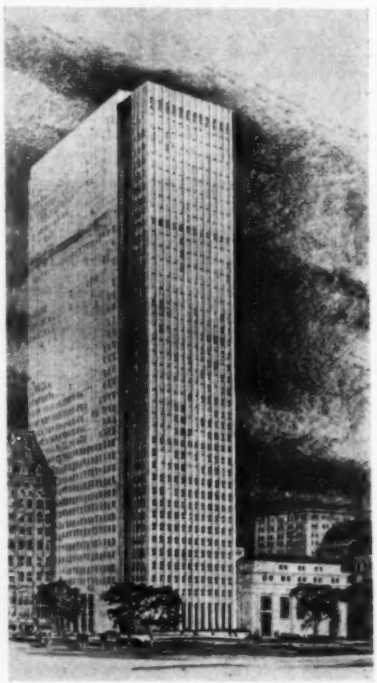
formerly supervisor of Commercial Engineering for Lamps, has been named to the same position in the South Pacific division.

Mr. Harper, who has been with Sylvania since 1946, joined the company as an industrial engineer in the New York office and has also been associated with the Electronics division in Boston, Massachussetts. Mr. Brady became associated with Sylvania in 1945 in New York City as a member of the commercial engineering department. Both men have been active in the Illuminating Engineering Society and in civic organizations.

Thomas Bryan and Associates, Inc. —Appointment of S. B. Duckworth as vice-president in charge of western division operations was announced today by Thomas S. Bryan, President of Thomas Bryan and Associates, Inc., constructors and engineers, Houston, Texas. Mr. Duckworth will be in charge of the corporation's projects in West Texas, New Mexico, Arizona, California, Nevada, Oregon and Washington.

Richard L. Young, construction superintendent of the Los Alamos, New Mexico, power plant project under construction by the firm, was named western division construction superintendent under Mr. Duckworth.

Frank Graziani, purchasing agent,



Architect's sketch of 40-story skyscraper under construction in Pittsburgh's Golden Triangle. It is the first of several new office buildings planned for an industrial center. This building, to be occupied by the United States Steel Corporation subsidiaries and the Mellon National Bank and Trust Company, will be the first large office structure to be completely air conditioned. General Contractor is Turner Construction Company, Heating and Air Conditioning will be done by the Dravo Corporation. Associated architects are Messers Harrison, Abramovitz, Cocken

will be transferred from Houston to Los Alamos as office manager on the power plant project.

Mr. Duckworth, vice-president in charge of engineering for the corporation during the past two years, is an engineer of long experience in the construction field. A graduate of Missouri State College, Cape Girardeau, Mo., Mr. Duckworth served from 1927 to 1940 as construction superintendent, Great Lakes Construction Co., Chicago, Ill., in construction of federal penitentiary, post offices, office buildings, and school buildings.

As construction superintendent for John Griffith & Son Construction Co., Chicago, from 1940 to 1943, he supervised construction of Navy bases and housing projects.

During 1943-1945, Mr. Duckworth served as a Commander, U. S. Navy, in charge of building and design of barracks, and other construction.

Iron Fireman Manufacturing Company—Election of two new officers in the Iron Fireman Corporation, a wholly owned subsidiary, was announced by president T. H. Banfield yesterday following the annual meeting of directors and stockholders. They are C. T. Burg, a former Portland, Ore. resident,

C. T. Burg

E. C. Webb

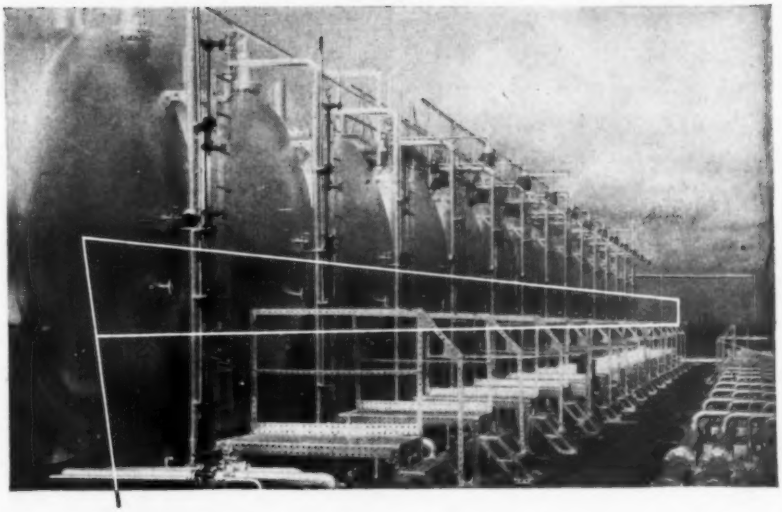
as president of the Iron Fireman Corporation and E. C. Webb of Cleveland, Ohio, as vice president. Burg has been in charge of Iron Fireman sales since inception of that concern 27 years ago while Webb has for many years been engineering service manager. Both men will continue to maintain offices at Cleveland.

The Philip Carey Mfg. Company—The appointment of R. F. Turner as sales manager-dealer products department was announced today by L. W. Clarke, vice president in charge of sales.

Mr. Turner has been active in the building materials industry since 1923 when he was affiliated with the Fischer Lime and Cement Company of Memphis, Tennessee. He joined Carey in 1934 and has served in the company's Chicago, Cleveland, and Philadelphia offices. Before assuming his present position he had been assistant district manager in the latter office.

Caterpillar Tractor Co.—The appointment of Dean Uhll, Western division service manager, to the position of export service manager for Caterpillar Tractor Co. has been announced by M. A. Clements, general service manager.

Mr. Uhll will relieve Ralph G. Dunn, assistant general service manager, who for many years has served as export service manager in addition to his



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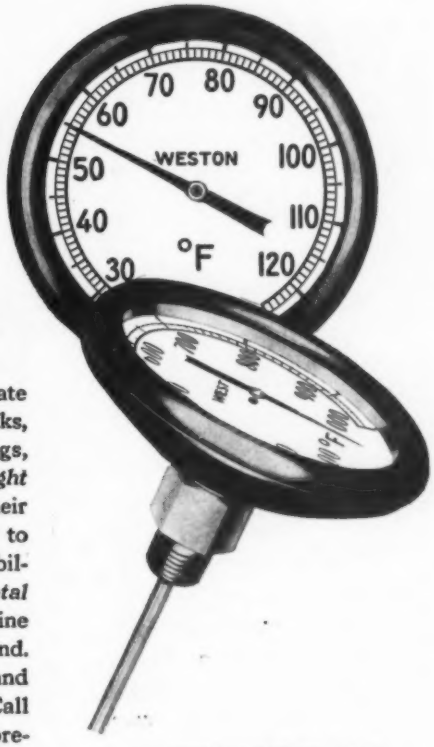

Wherever you need quick, accurate temperature readings—on tanks, processing equipment, bearings, pipe lines—specify WESTONS *right down the line.* Not only are their large, boldly marked dials easy to read, but their accurate dependability is assured by WESTON'S *all-metal* construction. They stay on the line longer—cost far less in the end. Available in types, stem lengths and ranges for most applications. Call your jobber or local WESTON representative, or write for Thermometer Bulletin. WESTON Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, N. J.

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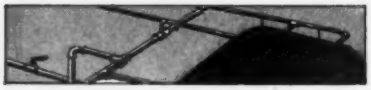
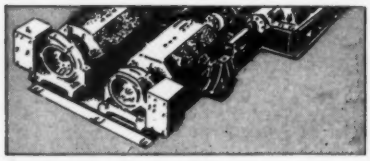
WESTON *Instruments*



Costly Machines!



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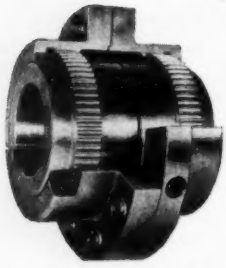

Its exclusive construction and operating advantages recommend this modern design coupling as the best protection for your sizable investment in expensive connected machines. Our Catalog 57 explains its safety factors. Copy on request.

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other administrative duties. At the same time the move will allow expansion of service activities to export dealers.

Coming with the transfer of Uhll is the announcement that Harrison Welch, Eastern division service manager, is to become Western division service manager. Welch's position as Eastern division service manager is to be filled by D. L. Lammers, a member of the service development division.

Uhll came to Caterpillar in 1936. He spent several years in field service and service training and three years as service engineer before heading up the Central division in 1946. He was named Western division service manager in 1948.

Welch attended Bradley University and joined Caterpillar in 1929. His first position was with the claims division of the service engineering department from which he went to the publications division until 1934. At that time he was made manager of the publications and tools division, and in 1938 he became assistant service manager. He was appointed Eastern division service manager in 1941.

Lammers, a graduate of Sacramento College, joined Caterpillar in January, 1946, after four years service in the Navy with the rank of Lieutenant upon his discharge. He gained his basic service experience prewar with Weaver Tractor Co., Sacramento, Calif., and Peterson Tractor & Equipment Co., San Leandro, both Caterpillar dealers.

Lee Rubber & Tire Corporation—Two important executive changes have been announced by Mr. A. A. Garthwaite, president. Mr. O. S. Dollison, formerly vice president and general manager of the Republic Rubber division, has been elected vice president of the Lee Rubber and Tire Corporation, with headquarters at Youngstown, Ohio. Mr. E. M. Ikirt, formerly assistant treasurer of the Republic Rubber

O. S. Dollison

E. M. Ikirt

division, has been appointed general manager of the Republic Rubber division. In announcing the changes Mr. Garthwaite stated, "These two organization changes will make it possible for Mr. Dollison to devote his time to the broadening of our product base and to use his valuable experience and trade contacts to improve our marketing relations with our Distributors and other classes of trade. Mr. Ikirt, who has been with Republic since 1918, with his broad knowledge of business and production problems, will be given a wider scope of activities and we feel confident that these two moves will

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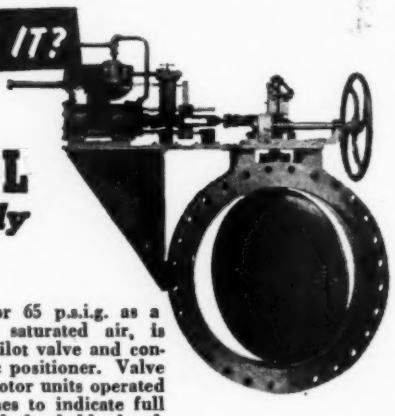

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rebound to the benefit of our organization."

Metals Disintegrating Company, Inc.—Announcement has been made of the appointments of E. Eugene Lenrow, as sales representative in New York State, and Raymond B. Hall, as sales representative in all New York counties except Niagara, Erie, and Chatauqua. He will cover the entire state on the sale of metal abrasives, special heat treated shot and diamond grit for the Harrison Abrasive Division of the MD organization.

Both of these new assignments supplement Mr. Lenro's current work in Metropolitan New York on MD metal

R. B. Hall

E. E. Lenrow

pigments. Mr. Lenro's experience covers over ten years in the sale of chemicals, paints, varnishes and lacquers in the New York and New Jersey areas.

Mr. Hall will handle the sales of metal pigments, aluminum paste and powder and gold bronze powders. His new assignment supplements his present post as sales representative in the New Jersey territory.

Mr. Hall joined the MD organization five years ago. He spent three years in the MD sales service laboratory in development and research work on a wide variety of customer problems in metallic pigment applications.

General Electric Company—Four appointments to sales positions in the General Electric commercial equipment division have been announced by Paul L. Chamberlain, manager of sales.

F. P. Barnes has been appointed sales manager of broadcast equipment; L. W. Goostree, Jr., sales manager of communication equipment; H. M. Wales, sales manager of marine and aviation equipment; and N. Gada, assistant to the manager of sales.

Mr. Barnes, a native of Portland, Oregon and a graduate of Stanford University with a degree in electrical engineering, joined GE in 1937 at Schenectady, N. Y. In 1942, he was named industrial electronics specialist at Seattle, Wash. Two years later he became Western district representative for the Electronics Department, covering northern California, the Northwest and Rocky Mountain areas. In August of 1948, Mr. Barnes was named assistant to the manager of sales for the transmitter division in Syracuse. Prior to his present appointment he was sales manager of land-mobile communications equipment, a position he has held since August of 1949.

Barnes is a member of the Institute of Radio Engineers and the American Institute of Electrical Engineers.

Mr. Goostree has been with General

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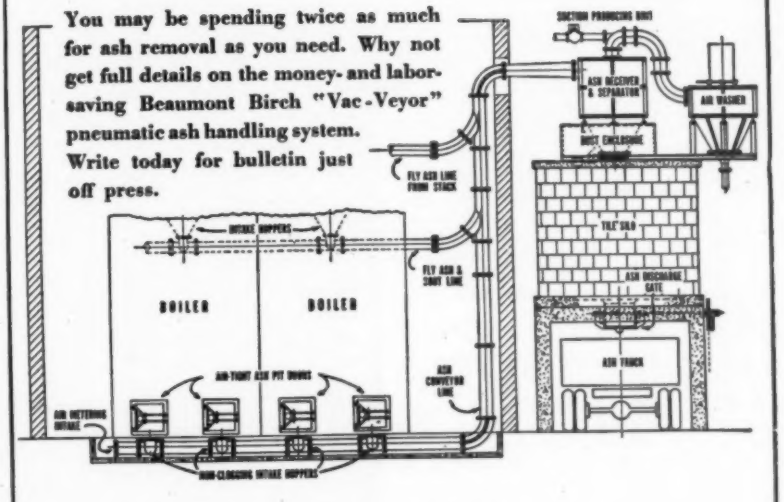

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Electric since 1941, following graduation from Southern Methodist University with a BS degree in electrical engineering. Between 1941 and 1945 he held a number of receiver and transmitter engineering posts and also worked on government projects for eight months at the M. I. T. Radiation Laboratories.

From 1945 to 1948 Mr. Goostree was district representative for the Electronics Department at Dallas, Tex., selling radio communications equipment. In October, 1948, he was appointed sales manager of marine electronic equipment with headquarters at Syracuse, a position he held until his present appointment. He is a member of Sigma Tau, honorary engineering fraternity.

Mr. Wales joined the General Electric Company in 1937 as a member of the test department at Schenectady, transferring to Industrial Department sales in 1938. Prior to the war, he spent a year with the Army Air Forces, on leave of absence from GE. In 1941 he joined the aviation division of the Industrial Department at Schenectady, engaged in the development and sale of aircraft and engine accessories for the armed forces.

In January of 1946 Mr. Wales was named sales manager of aviation electronic equipment for the transmitter division (now known as the commercial equipment division) at Syracuse. He held that position until his present appointment.

H. M. Wales is a native of Sewaren, N. J. He graduated from the Cooper Union Institute of Technology at New York City in 1937 with a BS degree in mechanical engineering. He is a director of the New York State Aviation Council.

N. Gada, a native of Niantic, Conn., graduated from M. I. T. with BS and MS degrees in electrical engineering. He has been employed in various commercial engineering and sales capacities with General Electric since 1926.

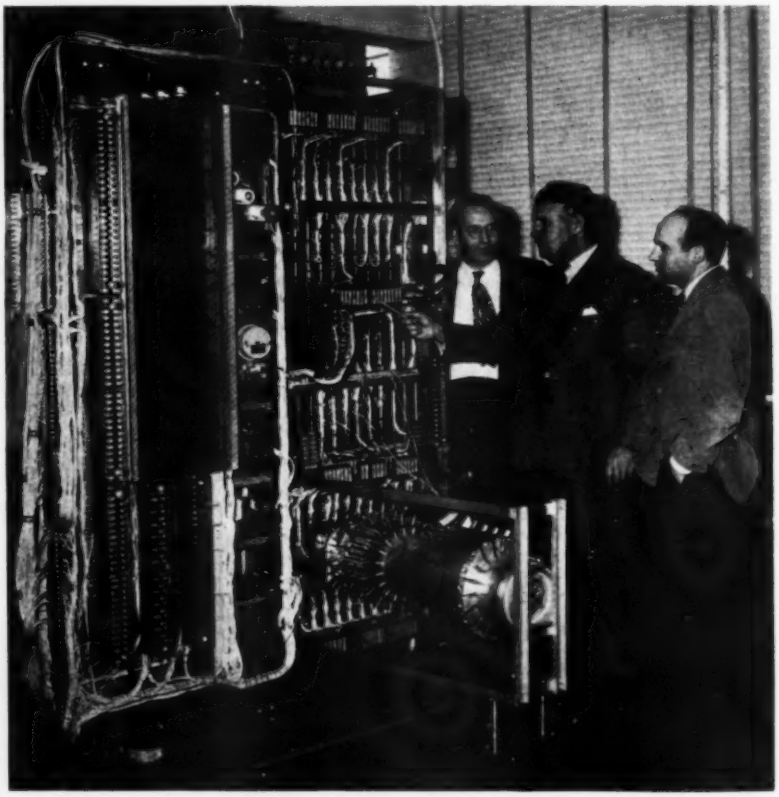
A veteran of World War I, Mr. Gada was an engineer at the Lynn River Works after completion of his studies at M. I. T. Assignments followed in the Central Station Division at Schenectady and at the Chicago office where he served as lighting specialist. He also held the position of central station sales engineer at the New Haven office.

Mr. Gada is a member of the Institute of Radio Engineers, American Institute of Electrical Engineers, and the International Muncipal Signal Association.

Johns-Manville Corporation—Appointment of T. J. Roberts of Atlanta, Ga., as Houston District Manager of the Johns-Manville Industrial Products Division, was announced today by C. G. Dandrow, Johns-Manville vice president and sales manager of the Industrial Products Division.

At the same time, Mr. Dandrow announced the promotion of Henry G. Palmer, to the post of Atlanta district manager of the Industrial Products

(Continued on page 149)



Dr. John W. Mauchly (left) and Professor J. Presper Eckert (right), inventors of the 'Univac' electronic computer inspect the 'mercury memory' assembly of the 'Univac' with Lt Gen Leslie R. Groves, USA(retired), Remington Rand's vice president and drector of the company's laboratory

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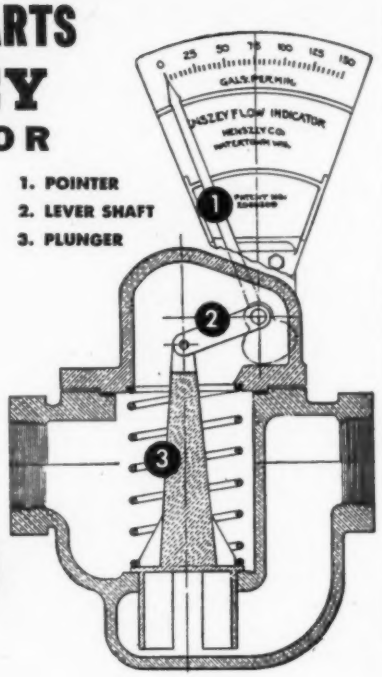

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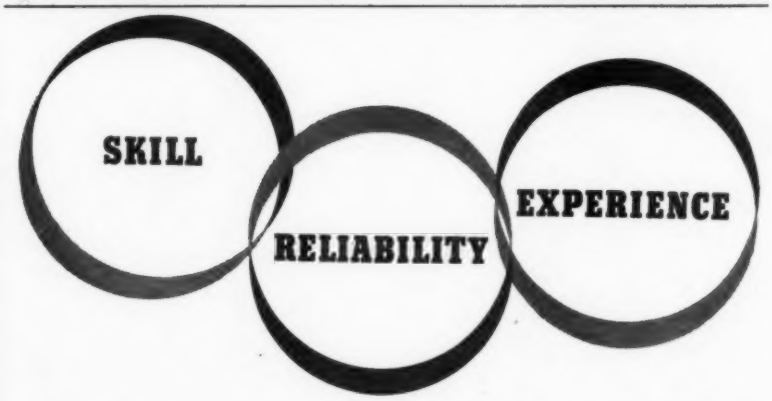

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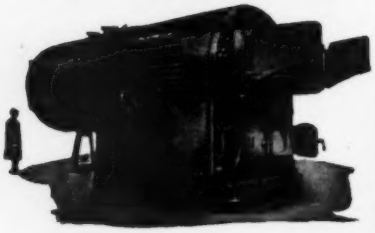

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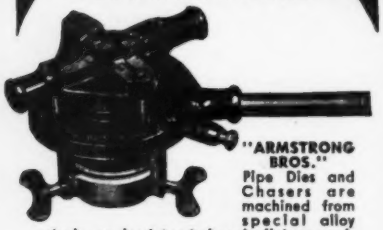

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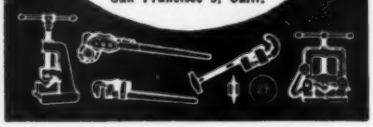
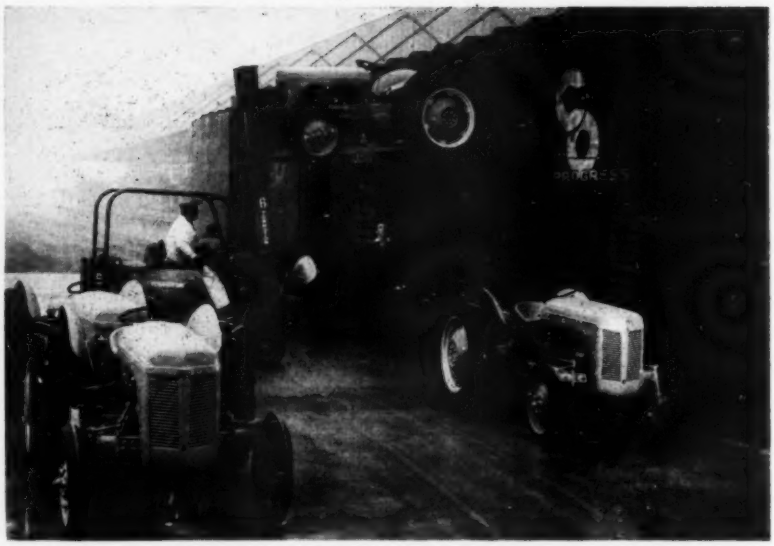
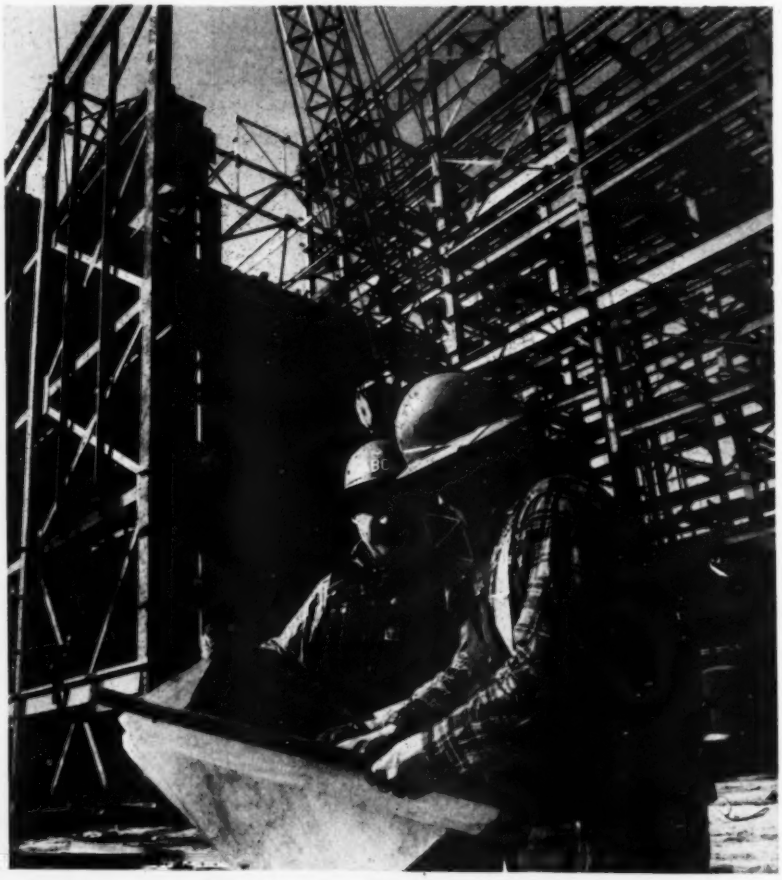




Tractors are loaded for rail shipment, at the Detroit tractor plant of the Harry Ferguson, Inc., with a Towmotor lift truck. To meet increasing field demands, the Ferguson company has run the production of tractors up to 160 units per day, which is the high point for this new tractor plant to date



Erection experts discuss plans for the giant power station addition being built at the South Chicago plant of the Carnegie-Illinois Steel Corp., U S Steel subsidiary. Donald E. Austraw (left) and Donald M. Murphy, crane foreman of another U S Steel subsidiary—American Bridge Company—are shown on the job. The project will be completed late this year or early in 1951

(Continued from page 147)

Division, succeeding Mr. Roberts. Mr. Palmer was formerly assistant manager of the Atlanta District.

A graduate of Cornell University, with a degree in Civil Engineering, Mr. Roberts began his career with Johns-Manville in 1925, in New York City, and has since held many responsible sales posts with the company. In his new position, Mr. Roberts will supervise sales of Johns-Manville Industrial Products in Texas and parts of Louisiana, Arkansas and Oklahoma. He will make his headquarters in Houston, Texas.

Mr. Palmer is a graduate of the University of Georgia and later attended Georgia Tech where he was awarded an advanced degree in Civil Engineering. He served during World War II as a Captain in the U. S. Marine Corps.

He joined Johns-Manville in 1936 as a sales engineer in the Atlanta district after six years as resident engineer with State Highway Department in Georgia. In his new post, Mr. Palmer will supervise sales of Johns-Manville Industrial Products in Georgia, Florida, Alabama, South Carolina and parts of Kentucky, Mississippi, North Carolina, Tennessee and Virginia. His headquarters will be in J-M's Atlanta offices.

Bituminous Coal Research, Inc.—Class A directors of Bituminous Coal Research, Inc., have been appointed to serve for another two-year term. The announcement was made here today by J. B. Morrow, BCR president, during the annual membership meeting of the national research agency of the bituminous coal industry.

The class A directors are: Edwin H. Davis, president, New York Coal Co., Columbus, Ohio; A. B. Foulger, vice president, Lion Coal Corp., Ogden, Utah; H. A. Glover, president, Island Creek Coal Sales Co., Huntington, W. Va; D. E. Griffith, president and general manager, Pruden Coal & Coke Co., Pruden, Tenn.; Ralph E. Jamison, Jr., sales manager, Jamison Coal and Coke Co., Greensburg, Pa.; S. S. Nicholls, vice president, C. H. Sprague & Son Co., New York, N. Y.; C. J. Potter, president, Rochester and Pittsburgh Coal Co., Indiana, Pa.; and R. H. Sherwood, president, Central Indiana Coal Co., Indianapolis, Indiana.

Class B directors who will be serving the second year of a two-year term are: George Dunglinson, Jr., executive vice president, Norfolk and Western Railway Co., Roanoke, Virginia; B. R. Gebhart, vice president, Chicago, Wilmington & Franklin Coal Co., Chicago, Illinois; J. B. Morrow, first vice president, Pittsburgh Consolidation Coal Co., Pittsburgh, Pa.; M. L. Patton, vice president, Traux-Traer Coal Co., Cincinnati, Ohio; P. B. C. Smith, president, Southern Coal Company, Chicago, Ill.; R. D. Stockdale, president, Red Jacket Coal Sales Co., Columbus, Ohio; D. A. Thomas, president, Boothton Coal Mining Co., Boothton, Alabama.

Foster Wheeler Corporation—Vice Admiral Earle W. Mills, United States Navy (Retired) was elected president of Foster Wheeler Corporation at the recent meeting of the board of direc-

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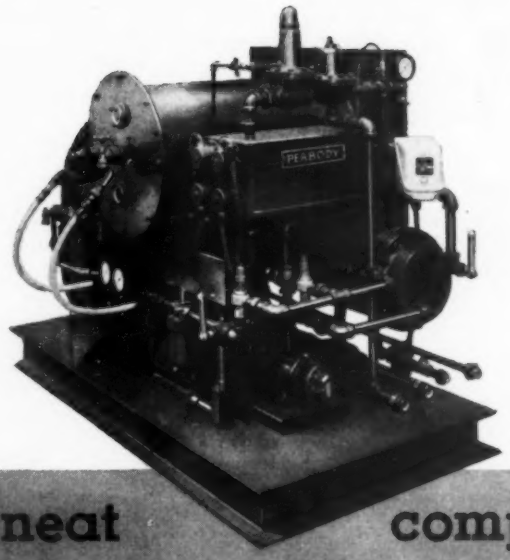

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INDUSTRY and POWER

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(Continued from page 149)

tors. David McCulloch, formerly vice chairman of the board was elected chairman of the board. Harry Sanford Brown, formerly chairman of the board and president, died suddenly on February 18, while on a voyage to South America.

Wartime deputy chief of the Bureau of Ships, and chief of that Bureau in 1946, Admiral Mills joined Foster Wheeler in 1949 as executive vice president and a director. For his long connection with ship machinery design, administration of the Navy's shipbuilding program, and as deputy chief of the Bureau of Ships during World War II, he was awarded the Navy Distinguished Service Medal. Admiral Mills was presented the David W. Taylor Medal in 1948 by the Society of Naval Architects and Marine Engineers for "Notable Achievement in Marine Engineering."

Admiral Mills was born in Little Rock, Arkansas, graduated from the U. S. Naval Academy in 1917, and received his degree of Master of Science in Naval Engineering from Columbia University in 1924. He was awarded the honorary degree of Doctor of Engineering by the University of Louisville in 1934.

Mr. McCulloch joined the Power Specialty Company, a predecessor of Foster Wheeler Corporation in 1906. In 1927 when the present Corporation was formed he was made secretary and assumed the duties of executive vice president in 1935, a position which he held until 1949 when he was made vice chairman of the board.

Western Electric Company, Inc.—Timothy E. Shea, president and a director of the Teletype Corporation, a subsidiary of the Western Electric Company, Inc., has been appointed personnel director of the parent company, it was announced today. He succeeds Joseph R. Bransford who was recently elected financial vice-president of Western Electric.

Mr. Shea resigned as president of Teletype Corporation effective February 28 and took over his new duties March 1. John J. O'Brien, vice president of Teletype Corporation, has been elected to succeed Mr. Shea.

A resident of Elmhurst, Ill., Mr. Shea has been with Western Electric since 1920. Prior to his election to president of Teletype Corporation in October, 1948, he was assistant engineer of manufacture at Western Electric's New York headquarters and previously had been engaged in development engineering in the Company's manufacturing operations. During the war Mr. Shea was on leave of absence from the Company, serving as director of War Research, Columbia University, and as a member of Division Six, Undersea Warfare Committee, National Defense Committee. In 1946 he was awarded the Medal for Merit and a Presidential citation for his war work.

Mr. Shea is a graduate of Massachusetts Institute of Technology from which he holds BS and MS degress in electrical engineering. He also holds a BS degree from Harvard University and was awarded an honorary degree of Doctor of Science by Columbia University.

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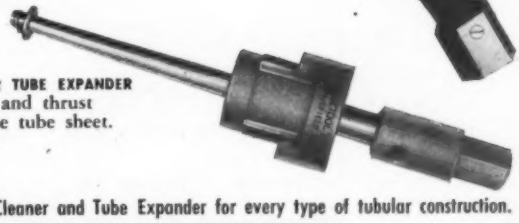
AIRETOOL BOILER TUBE CLEANER
for removing fuel wasting scale from straight or bent tubes.



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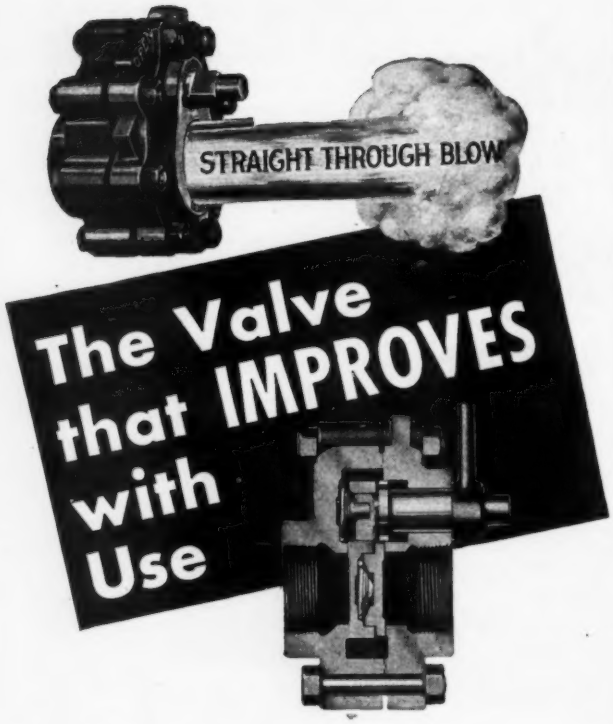

Yes, the EVERLASTING is a valve that actually ***improves*** with use. This is because of its unique design, in which the disc is always in contact with the sealing surface of the seat. Each time the valve is opened or closed, the disc moves across the sealing surface with a rotating motion, thus lapping one to the other. This self-lapping movement continuously polishes the sealing faces, which helps to perpetuate the drop-tight seal.

EVERLASTING Valves have additional superior features, too. Their straight-through flow minimizes pressure loss, they require no lubrication, and they can be opened or closed with less than a quarter turn of the operating lever. For more than 40 years, these unique valves have proven to be the best for blow-off, shut-off, equipment outlets, and many other services; and they are suitable for acids, alkalis, viscous materials and processs liquids as well as for steam, water, air and gas.

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Everlasting Valves
for everlasting protection

(Continued from page 118)

homa. It is now being produced in small quantities by The Eagle-Picher Co. laboratories in Cincinnati.

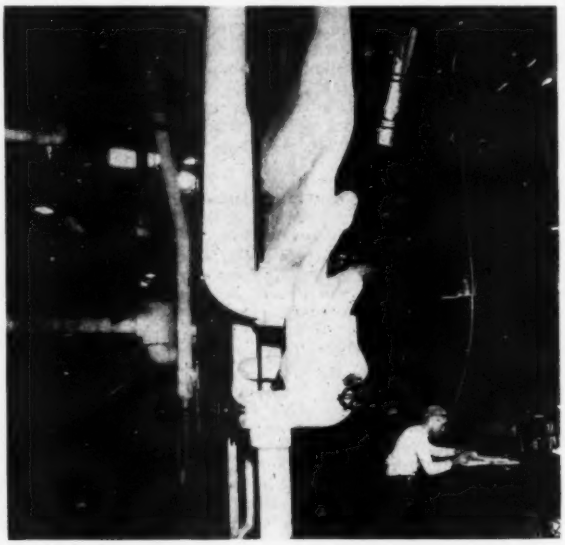
At present a price of $1,300 a pound is quoted. Stocks have to be kept in a refrigerator because of its extremely low melting point of 85°F. It is prepared for sale to laboratories in the form of metallic crystals of a distinctive thickened leaf shape, but above 85°F it melts into a silvery liquid.

For a time it was thought that another property of gallium, its high boiling point of 3,500°F, might lead to its use as a heat transfer agent in atomic power piles. However, this possibility later was discounted because of the relatively small amount of the metal in existence, and the large quantities of material that would be required for extensive atomic power development.

Mineral Wool Blankets Entire Bank of Steam Pipes

One chemical manufacturer, when insulating a parallel bank of high-temperature steam lines leading from a waste-heat boiler to an overhead distributor drum, insulated the entire bank as a unit instead of each pipe individually. This saved installation time, thus reducing costs. Mineral wool blankets and mineral wool insulating cement were also used for insulating large-diameter ducts, heat exchangers, economizers, and converters.

The blanket application was completed in two steps.



First, 1-in. thick mineral wool blankets, with wire mesh backing on both sides, were wrapped around the entire bank of pipes and secured in place with ½-in. galvanized bands on approximately 8-in. centers. The blankets were butted tightly together and laced with wire through the edges of abutting mesh. Second, a ½-in. coating of mineral wool cement was troweled over the blanketing to provide a tightly sealed, neat appearing exterior.

This same technique can be used out-of-doors, although thicker blankets are generally required due to seasonal temperature variations and greater average air movement over the surface. A coat of ¼-in. thick asphaltic weather-proofing with galvanized wire netting as reinforcing should be applied over the insulating cement.

Westinghouse to Build Large TVA Transformers

Four 140,000-kva, three-phase power transformers will be built by Westinghouse Electric Corporation's Transform-

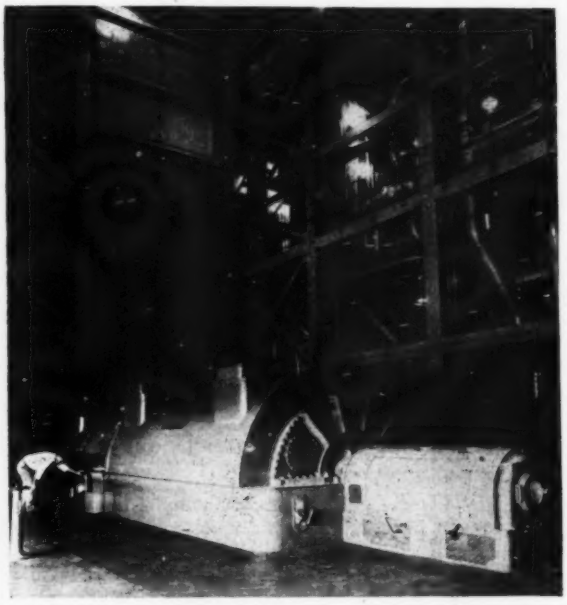
er Division at Sharon, Pa., for installation at the new Johnsonville, Tenn., steam plant of the Tennessee Valley Authority. The transformers will step up voltage from 13,200 volts at the generating plant to 161,000 volts for long-distance transmission.

Although these transformers will have smaller dimensions than some previously built by Westinghouse they will have a greater electrical capacity at this high transmission voltage than any constructed previously. Forced-oil and forced-air cooling plus improved engineering design and materials make it possible to build this high capacity into a smaller transformer frame.

The four transformers, each weighing 155 tons, will cost approximately $900,000. It is expected that they will be shipped by railroad, completely assembled except for bushings and coolers, by the middle of 1951.

Heart of New Potomac Edison's Station Is 40,000 kw Turbine-Generator

Potomac Edison's new $7,500,000 Riverton Power Station includes the illustrated General Electric 40,000 kw turbine-generator. Recently placed into service, the generator has an output voltage of 13,000 which is raised to



33,000 and 132,000 volts by an exterior bank of transformers for the company's existing transmission lines feeding a four-state area. When operating at full capacity, about 17 tons of coal per hour supply the turbine with its 900° F steam.

Constructed as a part of Potomac Edison's continuing program of service improvement, the Riverton Station will add its output to that already on their lines supplied by four other company stations and eleven small hydro-electric plants.

Dust Explosion Tests Made by Mines Bureau

Continuing its efforts to help designers of industrial buildings and equipment forestall heavy damage due to dust explosions, the Bureau of Mines has conducted a new series of tests to determine the effectiveness of various devices for venting explosion pressures harmlessly to the open air.

Although previous tests had shown that free openings provide the most effective vent, their use is impracticable in many manufacturing operations. For this reason, the recent tests were made with different types of closures. These

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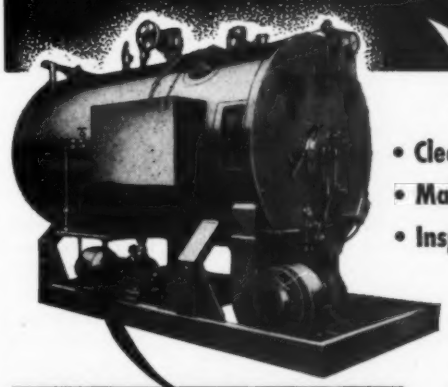

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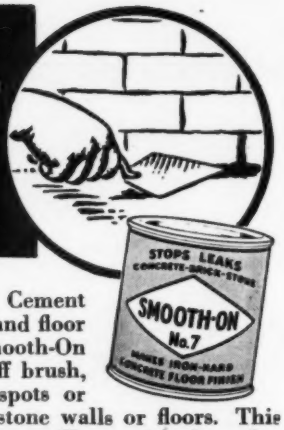

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Details of the tests are covered in Report of Investigation No. 4636, "Pressure-Relieving Capacities of Diaphragms and Other Devices for Venting Dust Explosions," available from the Bureau of Mines, Publications Distribution Section, Pittsburgh 13, Pa. The report also describes the various types of vent closures tested, some of which proved effective in preventing or at least minimizing the effects of dust explosions. It includes a table in which these closures are listed approximately in decreasing order of their effectiveness in venting explosions.

Improved Dock Facility Announced By Rail to Water Transfer Corp.

Construction of an improved and modernized terminal and dock facility for transferring coal from rail cars into lake carriers has been started by Rail to Water Transfer Corp. Located at 101 Street and Calumet River, Chicago, and costing approximately $350,000 according to L. M. Geissal, vice-president and general manager, it will be one of the most efficient dock facilities on the Great Lakes. The loading arrangement will incorporate latest construction features to minimize degradation and breakage, thus keeping coal in as near perfect condition as when it left the mine.

An important improvement is a 50 ton hopper from which a telescopic chute will be suspended. While loading, the hopper and chute will be kept full of coal at all times. The chute, constructed with a revolving head and clamshell type doors, and long enough to reach the bottom of the lake boats, will be able to effect perfect trim, using every possible available space in the hold of the vessel. This means increased loads for the lake carriers. All equipment for the new facility will be furnished by Heyl & Paterson, Inc., Pittsburgh, Pennsylvania.

It is estimated that the new facility will be ready by August 1. Building the new tower arrangement, however, will in no way affect current operations of the Rail to Water Transfer Corp., which is owned and operated by twenty-eight leading coal mining companies and shippers dealing exclusively in midwestern coals.

Steel Mill Purifies Waste Water Under Stream Polution Abatement Plan

Alan Wood Steel Company has just completed a modern water-treatment plant to purify waste water from the company's steel mills along the Schuylkill River in Pennsylvania. It is the first of its type to be built along the Schuylkill River to comply with the State's water purification program.

The installation not only eliminates the discharge of contaminating waste products from the steel mills into the river, but also acts as a water conservation unit.

Purified water is circulated repeatedly to the mill supply system. Water is drawn from the river only to make up for losses and to keep the system up to normal operating capacity. Water from the steel mills is diverted to the river only when the ready supply exceeds demands and the water that may be returned to the river is purified.

The plant has been under construction for more than a year at a cost of approximately $775,000.

Eastern States Receive Natural Gas From Texas Through 800-Mile Pipe Line

New supplies of natural gas destined for cities in Ohio, Pennsylvania and upper New York State began to flow a few weeks ago through the pipe lines of two of the country's newest long-distance transmission lines. Initial deliveries were made at Middletown, Ohio, where the Texas Gas Transmission Corp. (Owensboro, Kentucky) has a contract

calling for the delivery—later this year—of up to 235,000,000 cubic feet of gas a day through its new $73,500,000 800-mile Texas-to-Ohio pipe line.

The full capacity of the 800-mile Texas gas line is approximately 400,000,000 cubic feet a day. The pipe line, which went into preliminary operation as far as Louisville, Ky., last December, has also begun supplying additional gas to existing customers along the route. These include cities in Mississippi, Tennessee, Kentucky, and Indiana.

Full operation of the 800-mile project will give Texas Gas a daily delivery capacity of over 600,000,000 cubic feet a day throughout its entire system of 2,400 miles of pipe line.

New Coal Reserves Found In Maryland

More than 600,000,000 tons of semi-smokeless coal have been discovered in the lower beds of the Georges Creek field in Allegany and Garrett Counties, Md. The new reserves are found in 10 coal beds buried below the two that have provided most of the field's coal production. Those two beds have been mined for many years and are being worked out. As a result, production, which was about 2,250,000 tons a year before 1931, is now approximately 1,800,000 tons.

The lower-bed coals rank as low-volatile bituminous. It was found that the ash and sulfur contents, although rather high, can be reduced by washing, and that some of the coals may be suitable for use in blends to produce metallurgical coke. Another suggested use is as fuel in nearby metropolitan areas, such as Washington and Baltimore.

Indiana's Governor At U. S. Machine Corporation's National Jubilee

Indiana's Governor Henry F. Schricker (at the left in the accompanying illustration) congratulates Carl J. Winkler, president, and his three brothers on the anniversary of U.S. Machine Corporation which they and associates organized at Lebanon, Ind., in February of 1937 to manufacture heating equipment bearing the family name. The anniversary was observed in connection with the company's national jubilee meeting held at Indianapolis and attended by 600

Winkler distributors representing 37 states.

"We need more such manufacturing plants in the smaller communities—not only for a well balanced economy, but for defense purposes," said Gov. Schricker, who recalled that during his first term he presented the company with the first of five Army-Navy "E" production awards it received. "Although in business for themselves only 13 years, it is unusual in American industry that one segment

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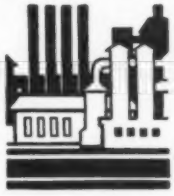

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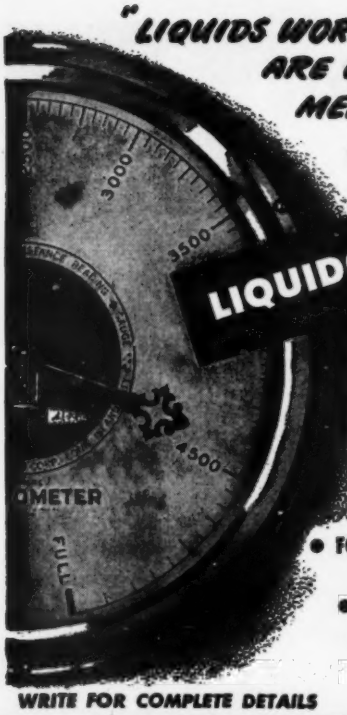

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of a family has an aggregate of 141 years of experience in machine and engineering skill," he added.

The company makes a complete line of equipment to burn oil, gas and coal, and broke its peacetime sales record in 1949. Other brothers shown in the illustration are Herman E. Winkler, executive vice president; Maurice and Walter Winkler, factory superintendents.

Pilot Plant Recovers Phosphorous From Sewage Effluent

Two University of Wisconsin engineers have announced that they have developed a pilot plant which may be able to take the phosphorous out of sewage effluent. Large-scale use of the discovery would mean:

1. Sewage effluent would no longer contaminate lakes and streams with surplus phosphorous, one of the elements held responsible for nuisance growths of algae.
2. Sewage phosphorous, which up to now has been lost, would be refined and sold as commercial fertilizer.
3. Atomic-research men would no longer have to worry about the danger from radio-active phosphorous in wastes.

The engineers who made the announcement are Profs. William L. Lea and Gerard A. Rohlich of the University's department of civil engineering. They have been working on the project for two years.

Scientists all over the world have been trying to do for years what Lea and Rohlich have now accomplished. Their method of phosphorous removal has not yet been tried on a large scale, but it looks like it will be effective and cheap.

Industries Using Rust Inhibitors With De-Icing Salts

Despite unseasonably mild weather in many industrial areas, several firms operating plants in the Middle West and New England began use this past winter of a rust inhibitor in conjunction with de-icing salt spread on factory parking areas, intra-plant roads, access roads and other privately maintained traffic ways.

A number of North American cities, state, county and township highway and street departments, and other public authorities have employed the rust-inhibiting material "Banox" with de-icing salt for the past two years, according to field service representatives of Calgon, Inc., Pittsburgh, which manufactures this additive. However, a check of their records for the past winter shows that several industrial firms have joined the movement, apparently on the theory that company-owned vehicles operating on plant property, and employes' cars, need this rust protection.

Here's the latest in heavy-duty all-purpose diggers. Tractor powered and hydraulically operated, it works at an angle and dumps on either side. Sherman Products, Inc., builders of the units, say it can dig a 50 ft long trench 6 ft across and 18 inches wide in approximately one hour

Lincoln Electric Gets Building Erected With "Breathing" Steel

Illustrated below are three stages in the erection of the "breathing" steel, Fiberglas and aluminum sidewall, being used by The Austin Company to enclose the new 850,000 square foot plant which it designed for The Lincoln Electric Company. The men on the left are installing Fiberglas insulating board, which is fastened to the inner steel (Ferrobord) wall by means of 10-gauge headless welding pins installed with the Nelson stud welding gun and on which the insulation is secured with a speed clip.

A section of the exterior wall, complete except for black aluminum coping, can be seen on the right, after removal

of the scaffolding. It is faced with deep box aluminum panels which are secured to the inner wall by Nelson studs and special aluminum transition washers and aluminum acorn nuts. These were developed by Alcoa and Truscon engineers to eliminate the possibility of galvanic action between the aluminum and steel wall components.

Portable Ion-Echange Unit Yields 10-Million-Ohm Water

Water which is virtually free from ionized impurities can now be produced quickly and at low cost by the new mixed-bed technique of ion exchange operated in a miniature exchange unit which weighs but 5½ pounds and requires only

one-third of a square foot of bench space. To the worker in operating, research or school and university laboratories, the new apparatus appears to offer a ready supply of high-quality water for preparing stock solutions and for the laboratory operations normally dependent on distilled water. The new apparatus, called the Deeminizer by its manu-

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facturer, the Crystal Research Laboratories Inc. of Hartford, Conn., yields up to five gallons per hour of water equal in chemical quality to triple-distilled. Fed with ordinary tap water, it can deliver a product with an electrical resistance of 10 million ohms—containing, in other words, only one part of ionic solids per 100 million parts of water.

It represents the first commercial application of the mixed-bed ion exchange technique, an important discovery announced recently by researchers at the Resinous Products Division of Rohm & Haas Co., Philadelphia chemical manufacturer. The instrument itself consists of a rigid polystyrene tube which accomodates a replaceable container filled with Deeminite—a mixed bed of specially converted Amberlite exchangers. The tube is mounted on a gray metal base, measuring 6 x 8 inches, which houses the meter.

In operation, a jar of water is up-ended in the top of the tube; the water passes through glass-fiber filters which remove physical impurities, then through the bed of resins which adsorb, or pick off and retain, the ionized impurities. Thus the single passage through the bed of resins produces a water free of sodium and silica, the sulfates and chlorides of calcium and magnesium, and other unwanted ions. Such a water contains no dissolved salts that interfere with the stability or accuracy of stock solutions, produce scale in steam sterilizers, or hamper the mixing and impede the working of photographic developers.

A built-in electrical conductivity meter shows the purity of the effluent at any time, and indicates accurately when to replace the cartridge. In soft-water cities like Hartford, the manufacturer estimates that one-million-ohm water may be produced for approximately five cents per gallon; in less fortunate areas like Chicago, for example, the estimated cost would be 25 cents.

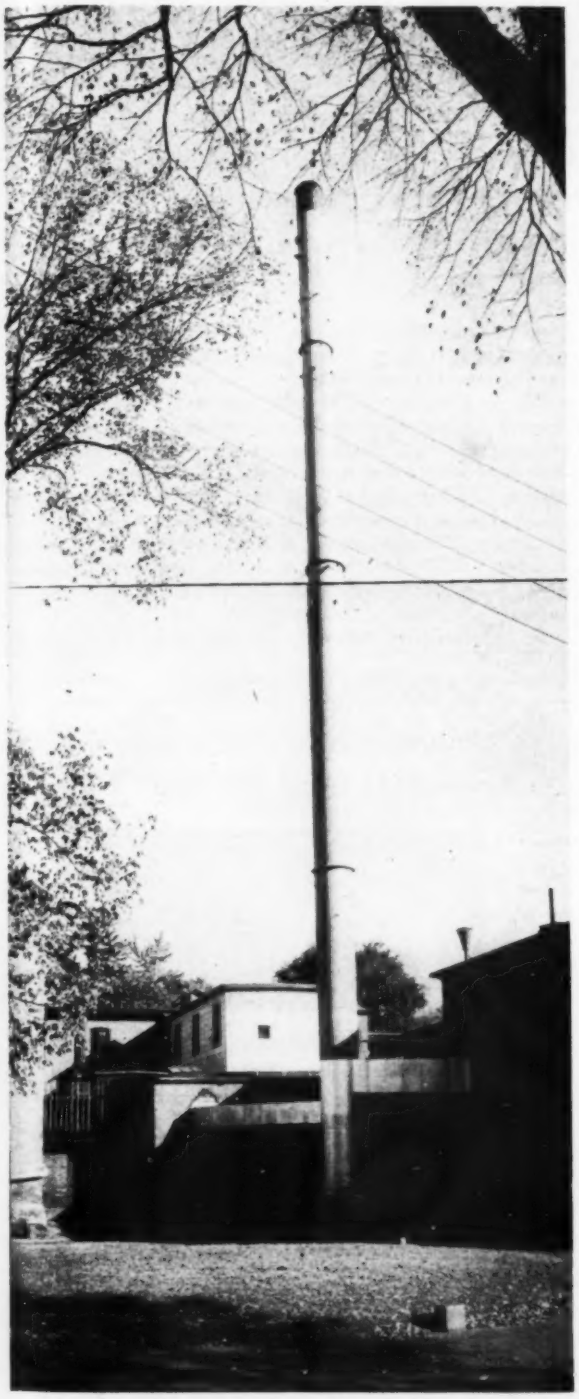
Diesel-Electric Car Operated in Gypsum Mine

How conversion of a shuttle car from storage-battery to diesel-electric power brought a speedier and more economical haulage to the Acme Gypsum mine of the Certain-Teed Products Corp., at Acme, Texas, is described in Bureau of Mines report. A shuttle car is an electrically-driven, rubber-tired truck especially designed for moving coal or ore in underground mines.

The conversion, believed the first of its kind, was de-

This 1200 ft conveyor belt presented an unusual problem for Goodyear Tire and Rubber Company's traffic department when the time came to ship the two-roll unit to a Pennsylvania customer. One of the longest belts ever shipped in one continuous piece, special highway permits were then required. Weighing more than 13 tons, the 42-in. belt was finally hauled to its destination on a "low-boy" underslung truck for bridge and underpass clearance

cided upon when longer hauls and considerable up-grade work slowed down haulage and exhausted shuttle-car batteries abnormally fast. It was accomplished by installing a Diesel-driven generator set in each storage-battery compartment in such a way that they would operate in parallel and



BIG BOY—Eight and one-half tons of wrought iron were required for this towering smokestack, recently erected at the Pittsfield, Mass., plant of the A. H. Rice Co., manufacturers of nylon and silk threads and braids. The contractor was William Allen Sons Company, Worcester, Mass. Wrought iron, not steel, was specified to combat corrosion

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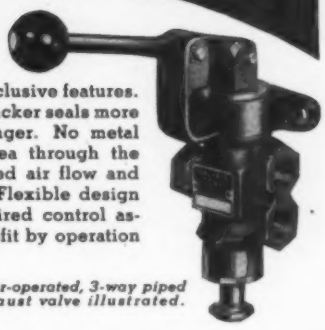

Adaptability, efficiency and dependability are had with "Valvairs" because of their many exclusive features. The unique "OU" type packer seals more effectively and lasts longer. No metal seats. Standard pipe area through the valve permits unrestricted air flow and prevents pressure loss. Flexible design allows virtually any desired control assembly. Rely on and profit by operation with "Valvairs".

★ ★ ★ *Lever-operated, 3-way piped exhaust valve illustrated.*

The VALVAIR line includes cam-, knob-, clevis-, foot-, treadle-, cylinder-, diaphragm- and solenoid-operated air control valves.

For use with air, water or oil pressures up to 175 lbs. p.s.i. and temperatures up to 120°F. 2-way; 3-way and 4-way open-end exhaust; 3-way and 4-way piped exhaust.

Sizes: ¼", ⅜", ½", ¾", 1"

Ask for Folder "A-P".

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AFFILIATE: SINCLAIR-COLLINS VALVE CO.

Rely Upon Valvair

TO OPERATORS OF H.R.T. BOILERS

As you know, riveted circumferential seams are subject to fire-cracking, which causes leaks and expensive repairs. National Seam Protectors insulate the seams from flame, preventing damage. Used for 34 years on thousands of seams. Recommended by inspectors. Write for complete information.

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Mica Shields and Gaskets
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Sight Flow Indicators
Safety Plastic Guards
Sight Glass and Discs
Flat Glass Inserts
Tubular Glasses
Try Cocks, Etc.

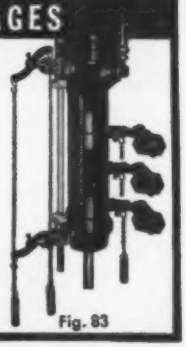

Fig. 83

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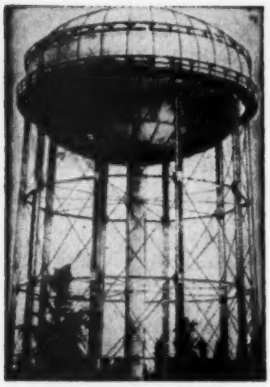
LIVINGSTON, N. J.



THE SILENT WATCHMAN

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Complete Service for Elevated Water Tanks
Nation Wide Service — 32 Years Experience

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By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely re-conditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for FREE Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

DIXIE'S NATION WIDE SERVICE SATISFIES

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

provide constant voltage, the report says. The efficiency of the sets was reported as about 95 percent.

Details are found in Report of Investigations 4643, "Shuttle-Car Conversion from Storage-Battery to Diesel-Electric Power, Acme Mine, Certain-Teed Products Corp., Acme, Hardman County, Tex.," by D. H. Platt, Bureau mining engineer.

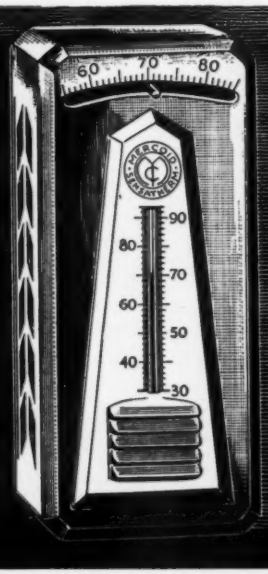
Engineers' Council Aims To Improve Competence of Members

We have just read the 17th annual report for the Engineers' Council for Professional Development, and find therein an encouraging across-the-board picture of what the engineering profession is doing to improve the competance of its members and to make engineering work more rewarding in personal satisfactions.

The ECPD is a conference organized in 1932 to enhance the professional status of the engineer through co-operative efforts of the following eight engineering organizations: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, National Council of State Boards of Engineering Examiners, The American Society for Engineering Education, The Engineering Institute of Canada, and the American Institute of Chemical Engineers.

It concerns itself with the professional, technical, educa-

The Mercoid Sensatherm



IT HAS WHAT YOU NEED IN A THERMOSTAT

It maintains a home in ideal comfort at any desired temperature.
It operates on a variation of ½° above or below the point set.
It is a corrosion-proof mercury switch contact equipped control.
It performs perfectly for years without any servicing attention.
It is a masterpiece in mechanical precision, design and appearance.

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One Layer of R & I Insulating Block Does the Work of Two

R&I #18 Insulating Block is a high as well as low temperature block, permitting *single* layer construction. It is equal in insulating efficiency to double-layer insulation at all temperatures up to 1800° F.

The use of one layer block construction will cut insulation cost greatly.

R&I #18 Block can be used wherever block insulation is required. Can be easily handled and easily cut.

It is unaffected by water and steam.

Furnished in thicknesses up to 5" and in standard sizes.

Ask for Bulletin I-76

R&I

REFRACTORY & INSULATION CORP.

118 Wall St., New York 5, N. Y.
Chicago 4, Ill. Newark 2, N.J. Philadelphia 2, Pa.

tional, and legislative phases of the life of the individual engineer. Its principal work is done by four standing committees who address themselves to the betterment in methods of selection and guidance of the student engineer, the content of his college curriculum, the orientation of the graduate engineer in industry, and finally the procedures by which he is awarded professional recognition. The actual work of the ECPD is done by some 300 educators and practising engineers who volunteer their services in the interest of the profession.

Gas Turbine Locomotive Completes 27,500 Miles of Rail Tests

The nation's first gas turbine-electric locomotive has performed successfully under almost every operating condition in road tests thus far. The 4500-hp unit has operated some 27,500 miles on various railroads since it was placed on the rails in November, 1948. Built by General Electric and the American Locomotive Company, it has been in freight service on the Union Pacific Railroad since last July.

Following are some of the data: (1) It has handled over 67 million ton-miles of freight traffic; (2) accumulated 1,900 hours of operation on the power plant; (3) operated satisfactorily on Bunker "C" oil, the lowest grade and cheapest oil produced; (4) performed in temperatures as high as 110° F and at altitudes up to 8,000 ft; (5) worked in tunnels up to a mile long with no indication of difficulty.

Complete operating statistics will not be assembled until some time this summer when later phases of the test work are completed.

The 500,000-pound, single-cab locomotive outwardly

MAKES BASEMENTS DRY!

Leaks in concrete walls can be stopped quickly with FLEXTITE. Actually seals against water pressure. Efficient as a plaster coat for sealing off water and dampness. Converts wet basements into dry useful space. Used in elevator pits, tunnels, dams, tanks, retaining walls. In reconstruction work, broken pillars and beams can be quickly reshaped with FLEXTITE.

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SELF-OPERATING REGULATORS and DIAL THERMOMETERS

Constant Temperature Regulation for

• HOT WATER TANKS • PASTEURIZERS • PRE-HEATERS
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• COOKERS • FEED WATER HEATERS • WATER JACKETS

Cut your processing costs to a new low with the Trerice Self-Operating Regulator. This dependable, experience-proven regulator provides trouble-free control . . . eliminates over-heating! Saves you steam, fuel and labor while affording improved "quality control" over your product. Your low, initial investment in the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer, will be repaid many times over during their first year of service.

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RUGGED — TOUGH EASY TO HANDLE

Forged steel hook and sheave . . . induction hardened extra heavy sheave pin . . . 3/8" steel plate sides . . . self-lubricated "Super Oilite" bearing give WECO SNATCH BLOCKS strength for heavy hoisting, and durability for long life.

The patented "Drop Side" makes it easy to string and unstring the block. Instead of the usual "needle threading" procedure just remove the wing nut, raise side, insert line, drop the side, and replace the nut.

Specify WECO SNATCH BLOCKS for greatest service and longest life. Write for bulletin.

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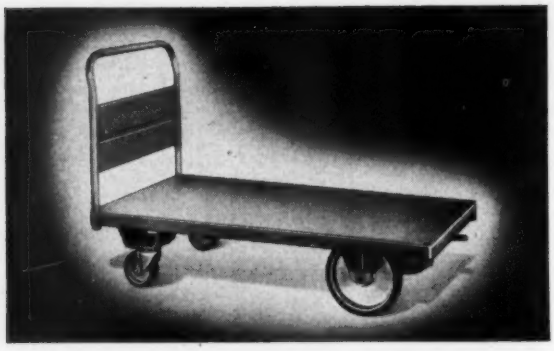

THE NEW HALLOWELL "700" Steel Platform Trucks

All-steel body eliminates excess weight, permits heavier loads per truck.

Heavy-duty construction lengthens truck life, reduces maintenance costs to the vanishing point.

New, functional design increases strength, provides better load distribution, makes handling easier.

Write for your copy of Bulletin 718.

HALLOWELL

MATERIALS HANDLING EQUIPMENT

See us at Space 128, A.S.T.E. Exposition, April 10-14, Convention Hall, Philadelphia

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JENKINTOWN 39 PENNSYLVANIA

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Also, send data on the ATLAS products checked below.

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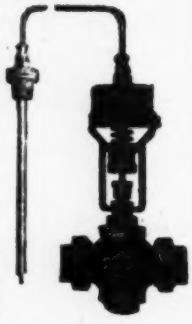
ATLAS

Self-Contained Type.

For complete data ask for Bulletin 7A which, for example, tells all about the Temperature Regulator shown at the right—No. 650.



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ATLAS Temperature Regulators are used for controlling the temperature of water and other liquids as well as vapors and gases, in all kinds of containers.

We also make special temperature regulators for special services not covered by our regular bulletins. We shall be glad to figure and consult with you on your special requirements.

For complete data on ATLAS Products use the coupon at the left.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

287 South St., Newark 5, N. J.

Represented in Principal Cities

resembles a diesel electric unit, but inwardly it is far different. The power plant, developed by the G-E Turbine Divisions in Schenectady, is a gas turbine similar in principle to those in jet planes. There is no jet effect, or thrust, however, as in a plane. The turbine is connected through reduction gears to electric generators. The locomotive exerts about twice as much horsepower at the rails as a diesel-electric unit of comparable size, requires virtually no water, and has few moving parts compared to a diesel-electric.

In Error, We Give Montana A New City

In the caption on the front cover of our March issue, we gave "New Billings, Montana," as the site of the illustrated catalytic creacker, designed and erected by the Fluor Corporation, Ltd., for the Carter Oil Company. Actually, the "cat" cracker is located at Billings, Montana.

When a publisher makes an error involving geographical information, he can bank on receiving letters and maps in facetious, humorous or serious vein. To date, we are pleased to report that none have arrived—probably because more complete data on Carter's "cat" cracker were given on our March "Contents" page, wherein Billings, Montana, was mentioned—and correctly so—as the plant's location.

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . ." October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
"How To Select Correct Steam Trap", Thomas Trail, January, 1950.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-To-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Cattell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant "Pressurized" To Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
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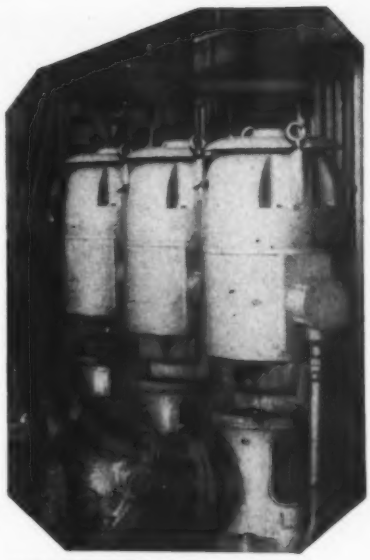

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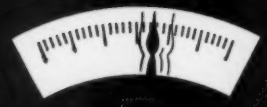
CONSTANT VOLTAGE
PRESENTS A

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